WILLATS'S

SCIENTIFIC MANUALS, No. 1.

PLAIN DIRECTIONS

FOR OBTAINING

PHOTOGRAPHIC PICTURES

BY

THE CALOTYPE, ENERGIATYPE,

AND OTHER PROCESSES ON PAPER;

INCLUDING THE

CHRYSOTYPE, CYANOTYPE, CHROMOTYPE,

ETC., ETC.

WITH ALL THE LATEST IMPROVEMENTS.

THIRD EDITION WITH ADDITIONS.

EDITED

BY JOHN H. CROUCHER.

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Price One Shilling.

ANOTHER edition of one thousand copies of this little work having been exhausted, the publishers avail themselves of the opportunity afforded them of introducing such improvements as have been made during the last twelve months. In common with the Editor, they beg to acknowledge the favour with which their efforts to elucidate the interesting science of Photography have been so generally received.

LONDON, *August*, 1847.

PLAIN DIRECTIONS

FOR

OBTAINING PHOTOGRAPHIC PICTURES BY THE CALOTYPE, ENERGIATYPE, AND OTHER PROCESSES ON PAPER.

The art of Photography, by which, through the agency of light, the most accurate and beautiful representations of objects are obtained, is the fruit of modern science and research. The darkening of nitrate of silver under the rays of the sun had, indeed, been long known, but no attempt was made to apply this fact to the purposes of art until 1802, when Mr. T. Wedgwood published a "Method of Copying Paintings upon Glass, and making Profiles by the Agency of Light upon Nitrate of Silver." That eminent chemist, Sir Humphrey Davy, assisted Mr. Wedgewood in his inquiries; but being unable to discover any mode of fixing the images obtained, the experiments were abandoned. About 1814, Mr. Niepce, of Chalons sur Marne, turned his attention to this subject; and in 1827, presented to the Royal Society of London some specimens of pictures produced by the agency of light on glass, copper plated with silver, and highly planished tin; soon after which he entered into partnership with M. Daguerre. The latter gentleman, after repeated but it would seem fruitless attempts to prepare a sensitive paper, entered upon those experiments which ended in the discovery of the beautiful

process on silver plates which bears his name. In the interval, Mr. Henry Fox Talbot made known the results of his inquiries into the action of light upon salts of silver, in a paper read before the Royal Society in January, 1839, which he followed up in the succeeding month by another, detailing his method of preparing a paper for photographic purposes, and fixing the designs. This paper was not, however, sufficiently sensitive to be used in the camera-obscura; but Mr. Talbot continuing his experiments, found means to increase the sensibility of his paper, and in 1841 patented the process, to which he has given the name of CALOTYPE, but which has recently (in accordance with the fashionable photographic nomenclature) been termed the TALBOTTYPE. Many distinguished scientific men have lately devoted their attention to this subject; and various processes on paper have been from time to time announced by—Sir John Herschel, Mr. Robert Hunt, and others, under the names of AMPHITYPE, ANTHOTYPE, CHROMOTYPE, CHRYSOTYPE, CYANOTYPE, ENERGIATYPE, etc., etc. The Daguerreotype, from its peculiarity and importance, demands a separate consideration, and is made the subject of a distinct number of the present series.* Avoiding, as far as possible, all scientific technicalities, we shall endeavour to give such concise and plain directions as will enable the amateur to obtain the most successful results. Those who may desire to learn something of the philosophical principles involved in the experiments brought under their notice in the subsequent pages, will do well to consult Mr. Robert Hunt's valuable work, entitled "Researches on Light," published in the course of 1844.

Before entering on the various processes we are about to describe we shall briefly notice the apparatus which the amateur will require, in performing this class of photographic operations. Where camera pictures are not desired, it will be simple and inexpensive.

Some camel's-hair brushes, a quire or two of good writing paper, and a few sheets of blotting-paper, are indispensable. The brushes should be large, the hair collected together in one pencil, and they must never be bound in tin. A separate brush is required for each solution, which should be thoroughly washed after using. The paper should be carefully selected: to a want of sufficient caution in this

* Photographic Manuals, No. 2. Second Edition. Practical Hints on the Daguerreotype. T. & R. Willats, 98, Cheapside, London.

respect, must be attributed the constant failures of many experimenters. Whatman's or Turner's superfine yellow or blue wove, is generally recommended; we have lately met with some very excellent paper, which can be had at the publishers. Every sheet should be examined by a strong light, and all those rejected which have any spot upon them, as also those which are found on trial to imbibe the solutions unequally. One side of the sheet should have a pencil mark upon it, by which it may be recognised. The blotting-paper must be the white wove, and the sheets used in different stages of the process should be kept separate. A trough of Berlin ware, which is not acted upon by chemical preparations, and a slab of the same material, are also required for preparing and washing paper.

Copying Frame.

All that is absolutely essential for this purpose, is a piece of plate glass of a sufficient size, and a board of similar dimensions covered with soft flannel; these, with the prepared paper and object to be copied placed between them, may be kept in contact by three or four binding screws. But the more convenient apparatus is represented at fig. 1 consisting of a frame in which a piece of plate glass (*a*) is fixed, in a frame

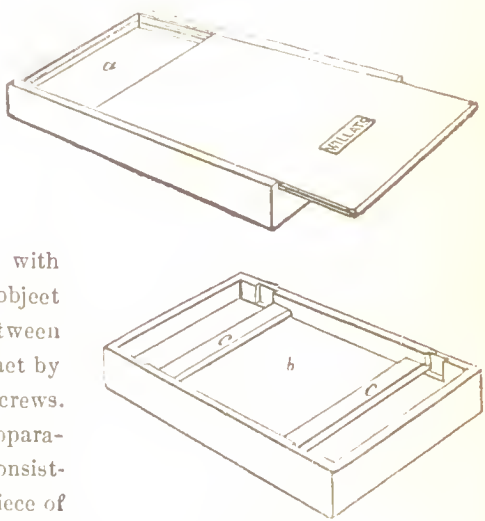


Fig. 1.

with a wooden back covered with a cushion of flannel. The back may be removed to admit of the introduction of the paper and object, and when replaced, may be pressed evenly and firmly against the glass by screws (*cc*) placed at the back. A sliding-top covering the glass excludes the light, until it is desired to submit the paper to the action of light, or to protect it from change if kept for a short period without setting.

The Improved Pressure Frame (Fig. 2.)

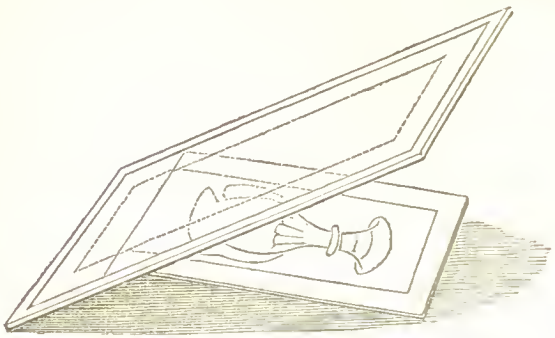


Fig. 2.

This is a more perfect form of apparatus than that just described: a door at the back admits the prepared paper and the object to be printed, while close contact is secured by clamps at each corner, which press down the glass firmly and evenly. By a simple arrangement, it can be opened at the back, so as that the progress of the impression may be ascertained without disturbing either the paper or the copy.

Camera Obscura.

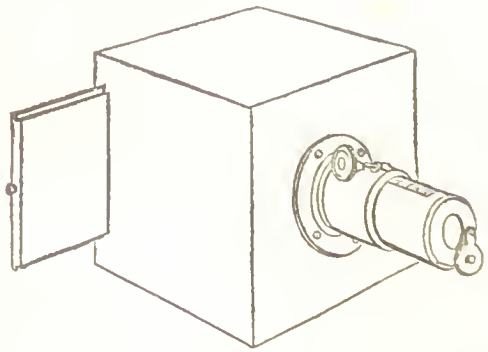


Fig. 3.

The Camera Obscura adapted for photographic purposes, is a very superior instrument to that commonly sold under the name. The lens may be either achromatic or miniscus.

WILLATS'S IMPROVED CAMERA, (FIG. 4,)

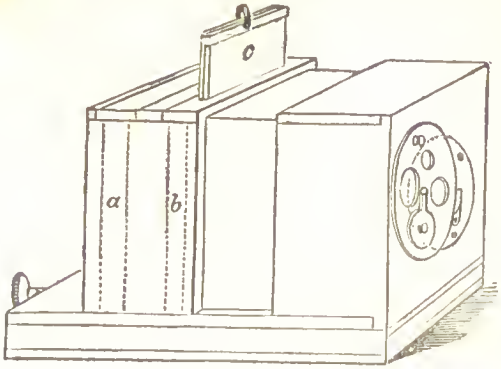


Fig. 4.

Which may be used for any photographic purpose, is a box, in the front of which the lens is bedded, by which an increase of light is obtained, the quantity admitted being regulated by a diaphragm having apertures of different diameter. The back part of the camera slides into the front, and to secure a very accurate adjustment, is mounted with a screw. It is moved in or out by turning a small handle at the back. The frame with the ground glass is furnished with a moveable top and sides, which, when extended, exclude the light, and aid the operator in determining the best focus.

The second frame consists of a box, which, when the eamera is applied to processes on paper, is made to receive a piece of slate,

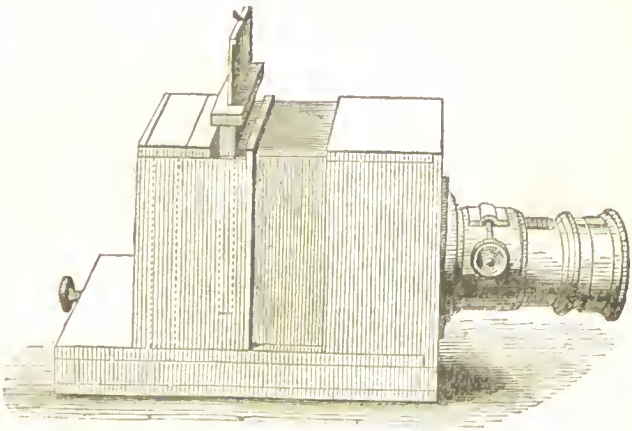


Fig. 5.

iron, or glass, which is held tight by a spring at the back: this frame is furnished with a sliding door, laying over the top of the camera when raised. A picture four-inches square may be taken in this camera. The lens is usually $1\frac{3}{4}$ inch in diameter, and from eight to twelve inches focus. This Camera is sometimes mounted with double combination lenses, as in fig. 5.

A Camera more especially adapted to the Calotype process is now constructed on a plan recommended by Mr. Cundell. A single miniscus lens may be used, or two miniscus lenses, each about three inches in diameter,

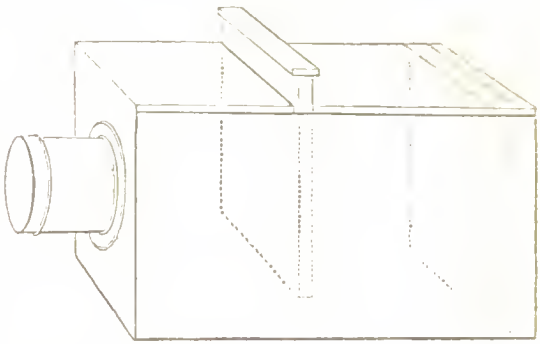
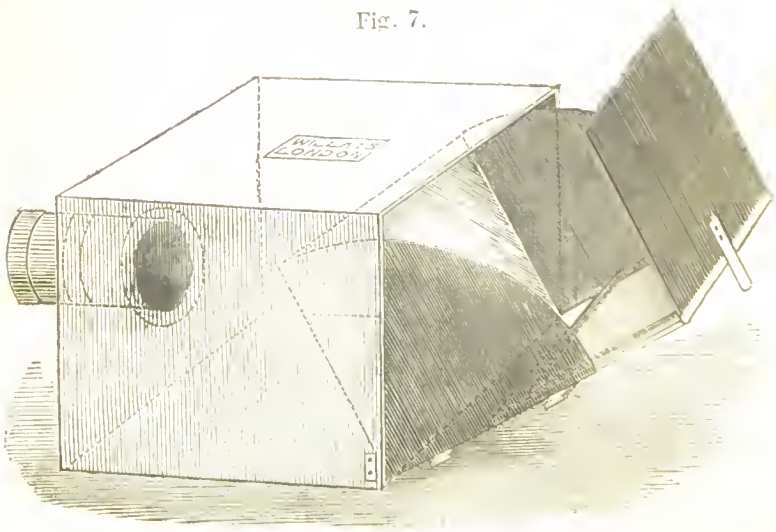


Fig. 6.

and twenty-four inches in focus, are mounted in a sliding tube. their conjugate foci being as that of a single lens of thirteen inches. These, with an aperture of about one three-tenths inch, and with one or more stops behind the lenses, give a picture beautifully defined. The focus is adjusted, and the prepared paper exposed, much on the same principle as the other camera above described.

Fig. 7.



The Camera on the other side has a very novel and convenient arrangement for obtaining the focus, and exposing the prepared paper: it is the invention of Mr. Hazel. The frame destined to receive the slider containing the paper, and the ground glass upon which the focus is obtained, are arranged at right angles to each other and turn upon a joint, at the lower edge of the back part of the Camera. The focus being obtained, the slider with the prepared paper is introduced into the frame, when, by turning it upwards, the ground glass falls to the bottom of the camera, while the slider exactly occupies its place. By an ingenious arrangement, a short lever connected with the slider, at the same moment raises the shutter which secures the paper from the light.

The Camera represented, Fig. 9, is a new and very useful article, being made to fold up into the compass of a moderate sized book, and may be carried in the pocket without inconvenience. It is so arranged as to put together with the utmost ease, and is kept securely in its place by screws in the sides and back.

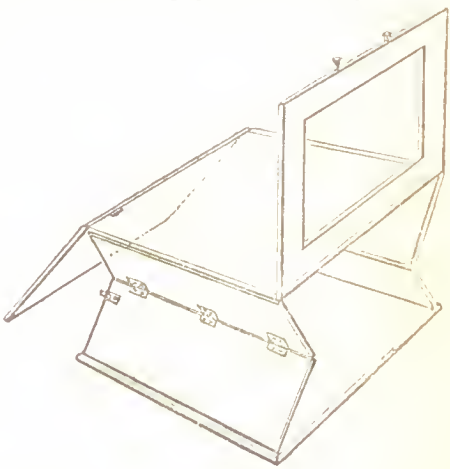


Fig. 9.

THE PHOTOGRAPHIC ETNA, (FIG. 10,)

For bringing out the picture by the aid of steam, is highly useful, as the picture is kept moist while the process of development is going on. This is a very great improvement on the tin bottle formerly used, the rapid drying of the paper causing great discoloration and want of uniformity in the development of the image. The old form with a slate side, may however be procured by those who prefer its use. Fig. 11.

Fig. 11.

Fig. 10.

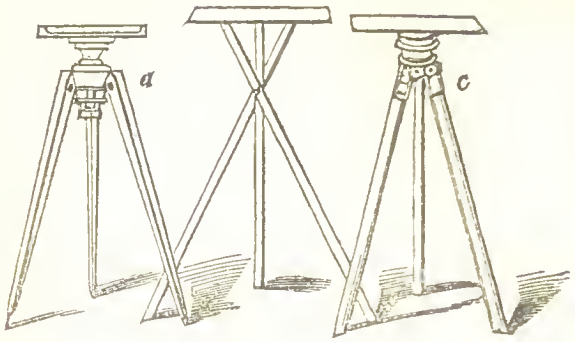


Fig. 11.

THE TRIPOD STAFF, (FIG. 6,)

Upon which the camera may be rested, when no other suitable place can be found, is a very necessary auxiliary in taking views. It is about four feet six inches high, and carries a small table on which the camera is placed. There are several varieties, differing in their construction and price.

THE HEAD REST, (Fig. 12.)

May be fixed to the back of an ordinary chair, and may be raised or lowered, and moved forwards or backwards, at pleasure. It is indispensable in taking portraits.

Chemicals.

These should be all of the best quality, and should only be purchased of respectable parties who will guarantee their purity. Cheap chemicals are seldom economical, as the adulteration of any of them will interfere most annoyingly with the successful prosecution of the experiment. The following list comprises almost every article required in the processes hereafter described:—

Nitrate Silver* in chrystals	Ammonia-citrate Iron
Iodide Potassium	Ferro-sesquicyanuret Potassium
Bromide Potassium	Yellow Ferro-cyanate of Potash
Hyposulphite Soda	By-chromate Potash
Pure Gallic Acid	Sulphate Copper
,, Succinic Acid	Nitric Muriatic Acid
Proto-sulphate Iron	Strong Ammonia

THE CALOTYPE.

The Calotype, or Talbottype, is, as we have already mentioned, the invention of Mr. Fox Talbot, or is claimed by him.† It has been much improved since its first introduction. To Mr. Cundell in particular we are indebted for many practical suggestions, which he first communicated to the world in the' Philosophical Magazine,'‡ and the more recent experience of other photographers has produced valuable modifications of the original process. Giving such simple directions for conducting it as we have found the most likely to produce satisfactory results, we shall include such variations as seem worthy the attention of the amateur.

* The Nitrate of Silver in solution is very easily affected by light, and should be kept in a dark place.

† So early as April, 1839, the Rev. J. B. Reade made a sensitive paper, by using an infusion of galls after nitrate silver. By this process Mr. Reade obtained several drawings of microscopic objects, by means of the solar microscope. The drawings were taken before the paper was dry. In a communication to Mr. Brayley, Mr. Reade proposed the use of gallate or tannate of silver; and Mr. Brayley, in his public lectures in April and May, explained the process, and exhibited the chemical combinations which Mr. Read proposed to use.

‡ No. 169, May, 1844.

Preparation of the Iodized Paper.

Having selected paper of a close and even texture, and fine surface, such as that recommended p. 4, and marked it on one side with pencil, wash this side over carefully with a solution, consisting of 30 grains nitrate silver, dissolved in one ounce distilled water, which apply plentifully with a brush, thoroughly wetting every part, but leaving no moisture unabsorbed; this should be done on a hard smooth board, and thoroughly dried in the dark. Then take a solution of two hundred grains of iodide potassium in half-a-pint of water, to which fifty grains of salt have been added; draw the paper over the surface of the liquid, letting it repose upon it, when plastic, for a few seconds, never more than one minute. After dipping, drain it, and lay it flat until about half dry, then set it afloat in clean water for ten minutes, drawing it now and then along the surface: hang it in the air to dry, and when dry smooth it by pressure. It is of the utmost importance that all the soluble salts should be got out of the paper, and this is readily effected by leaving it floating for a time in water: a rougher washing would loosen the iodide of silver. This paper will keep some time if carefully laid by in a portfolio.

Application of the Gallo-Nitrate of Silver.

Dissolve fifty grains nitrate silver in two ounces of distilled water, to which add one-fifth of its volume of glacial acetic acid. Dissolve also a small quantity crystallized *gallic acid* in distilled water, about eight grains to the ounce.* When about to use, mix one part of the latter solution with two parts of the former, mixing however only a sufficient quantity for immediate use, as the resulting liquid decomposes very rapidly. This, and all the operations connected with the Calotype, should be conducted in a room from which daylight is entirely excluded: it is, indeed, preferable to surround any artificial light, which may be used, with a screen of yellow glass, gauze, or paper, the rays which pass through materials of this colour having little or no influence on the most sensitive preparations. The iodized paper may now be washed evenly over on the prepared side, which may be recognised by its pale yellow colour, with the gallo-nitrate mixture, and must then be immediately

* A small quantity only of the gallic acid solution should be made at once, as it soon undergoes a change, becoming of a strong yellow colour, and unfit for use.

transferred to clean blotting-paper, and all the moisture carefully removed from the surface. A more even distribution of the gallo-nitrate solution may, perhaps, be obtained by pouring a little out on a slab, and passing the iodized paper over it, taking care that contact in every part is secured, and blotting as before. To save time, the gallic acid may be applied previously, and the paper kept thus, half prepared.

Placing in the Camera.

Having prepared iodized paper as directed above, in which state it is called calotype paper, it should be quickly transferred to the camera frame, enclosed between a plate of slate or iron, and a piece of plate glass to keep it smooth. If the slate or iron be gently warmed, the sensibility of the paper will be increased. The camera must now be put in the proper position, directed towards the object to be copied, and a good clear picture obtained on the ground glass. This picture, when an achromatic glass is used, will give a good working focus, but when the camera is fitted with a miniscus, or any other kind of non-achromatic lens, a peculiar adjustment is necessary to obtain what is called the chemical focus, which differs materially from the optical or visible focus. This chemical focus is about one thirty-sixth part shorter than the other, but the scale should be adjusted according to the lens and camera used. The frame, with the prepared paper, the shutter being perfectly closed, is now placed in the camera. The time of exposure here depends upon so many circumstances,—the strength of the light, the colour of the object, the description of lens used in the camera, etc., etc., that it is impossible to give any practical rules upon the subject,—experience will be the best instructor. With a single achromatic lens in the morning sunshine, from thirty to sixty seconds is perhaps requisite for a building, and from one to two minutes for a portrait: in the shade, from two to three minutes are required for either. Pictures are taken in a much shorter time, in from ten to twenty seconds, by using a combination of lenses, or with a single lens, under very favourable circumstances. The best position for taking a building, is a distance about twice the measure of its greatest dimension, and from an elevation of about one-third of its height. Where some parts of the building are nearer than others, place the focus to that part which it is most desirable to have clear, and neglect the others. It is not advisable to take new and old buildings in the same

picture, as the time necessary for the old will over-do the new. The sky is frequently overdone, which may be prevented by interposing a black-screen upon the glass over that part which corresponds to it, and which may be previously ascertained by referenee to the ground-glass. Portraits should be taken in the open air, but not in the sun. The best uniform back-ground is a blanket, but figures may be grouped in front of a house, or a mass of foilage. There should not be too mueh white in the dress, as it will be solarized or blotched, before the other parts are distinctly pourtrayed. More particular dircetions for obtaining artistical portraits will be found in No. 2 of the present series.

Bringing Out the Impression.

When the paper is removed from the frame, always in the dark, nothing is visible; it must then be again washed over with the gallo-nitrate of silver, and exposed to a radiated heat from a gentle fire, or a bottle of hot water, or to what is still better a jet of steam, holding the paper over it, never suffering the paper to become in any part perfectly dry.* When the picture is, in the opinion of the operator, sufficiently distinct, it must be carefully washed in distilled or rain water, as warm as the finger can bear—the water being changed once or twice, and then dried in blotting-paper.

Fixing Process.

To fix the picture, soak it for two or three minutes, or longer if strongly developed, in a solution of half an ounce of hyposulphite soda to a pint of water, turning it occasionally, and then soak it in water from twelve to twenty-four hours, according to the thickness of the paper, and dry it. The sweetness of the hyposulphite of silver, which is readily communicated to any quantity of water, affords an excellent means of testing when the picture is freed from its influence. It should be washed until the water is perfectly tasteless.

The Calotype process is intended solely for the camera-obscura, and the pictures so obtained are all negative; that is, the lights and shadows are reversed. From these, however, any number of positive pictures, or

* A convenient apparatus for this purpose is described page 9, and may be had of Messrs. T. & R. Willats.

pictures in which the lights are represented by lights, and the shades by shades, may be taken in the manner described under the next head.

Mr. Fox Talbot has published a method of removing the yellowish tint from pictures taken on calotype and other photographic papers prepared by nitrate of silver, by plunging the picture into a bath composed of hyposulphite of soda, dissolved in ten times its weight of water, and heated nearly to the boiling point. The picture should remain in it about ten minutes, and be then washed in warm water and dried. By this means, he says, the picture is rendered more permanent, and the lights whiter. He also recommends the following means for improving photographic pictures :—

"A copy or reversed impression of a photographic picture is taken in the ordinary manner, except that it remains in the light twice the usual time; its shadows are thus rendered too black, and its lights not sufficiently white. It is then washed and plunged into a bath of iodide of potassium (of the strength of five hundred grains to each pint of water) for one or two minutes, which makes the picture brighter, and its lights assume a pale yellow tint. After this it is washed, and immersed in a hot bath of hyposulphite of soda, until the pale yellow tint is removed, and the lights remain quite white. The pictures, thus finished, have a pleasing and peculiar effect of light and shade, which is not easily attainable by other means."

The transparency of calotype and other pictures may be increased by causing melted wax to penetrate the pores of the paper in the following manner. A small quantity of white wax is scraped on the back of the picture; it is then placed between two other papers, and a hot iron passed over it, which melts and spreads the wax. Or a little boiled oil may be spread over it, and the excess removed by bibulous paper. Canada balsam, or mastic varnish, with turpentine, are very good materials for the same purpose.

It may be necessary to remind the reader, that the CALOTYPE is a patented process. In the two patents obtained by Mr. Fox Talbot, the use of the following processes is claimed as his exclusive right.

The employment of gallic acid, or tincture of galls, in conjunction with solutions of silver, to render prepared paper more perfect. The obtaining portraits from life by photographic means upon paper. The employing Bromides for fixing the image obtained. The transferring pictures from one sort of sensitive paper to another. The employment of

boiling sulutions of hyposulphites, to give increased whiteness to calotype and other photographic pictures; and the process of waxing, when the picture has been rendered more transparent by these means. The process of warming the paper, during the formation of the image, by placing a warm plate of iron behind it to increase the sensibility. The employment of iodized paper excited or rendered sensitive by a liquid, containing only a small portion of nitrate of silver, and subsequently dried; so as to preserve its sensitive state. The varying lights and shadows of a picture by iodide of potassium, and the fixing the picture so changed. The placing a sheet of white or coloured paper behind photographic pictures after having waxed them. The obtaining enlarged portraits and pictures by throwing a magnified image thereof, by lenses, on photographic paper. The application of photography to printing, by arranging suitable letters or figures, so as to form pages, and making photographic images thereof. The system or combination of the following several photographic processes into one, whereby permanent and perfect copies of the positive kind are obtained, namely, the formation of the negative copy—the fixing it, so that it shall have the requisite transparency, and endure great subsequent exposure to the light—the formation of the positive from the negative copy, and its permanent fixation.

The subjoined modification of the Calotype process has been kindly furnished by a very successful practitioner:—

1. Wash the paper with a brush filled with a solution of nitrate silver three grains, distilled water one ounce.

2. When it is half dry, draw it over the following solution, letting it float on the surface for about half a minute:—Iodide of potassium 200 grains, salt 500 grains, water half-a-pint; then withdraw it and set it afloat in pure water for ten minutes; dry and preserve in a portfolio.

3. When you wish to use the paper, prepare three solutions: No. 1, Nitrate silver 50 grs.; acetic acid two drams: water one dram. No. 2, A saturated solution of gallic acid. No. 3, 15 drops of No. 1; 15 drops of No. 2; water 90 drops. Cover the face of the paper with this solution, by means of a very soft brush; taking up the excess of liquid with blotting-paper; put it into the camera, and expose it for a time, depending on the strength of the light.

4. After taking it from the camera, brush it quickly over with a

mixture containing 30 drops of solution No. 1, 30 drops of solution No. 2, 60 drops water; then expose to heat until the picture is sufficiently developed.

5. Well wash the picture and pass between blotting-paper, then into a bath of hyposulphite. Wash it afresh in plenty of water and dry.

Mr. Brodie, whose specimens of Photography upon paper are so beautiful, has kindly communicated the following modification of the Calotype process which he has adopted.

A good paper (Mr. B. prefers Nash's) is marked, the marked side passed over a solution of ten to fifteen grains nitrate silver in one ounce distilled water, every part touching the solution, and is dried gently by the fire. It is then immersed in a bath of iodide potassium fifteen grains to the ounce of water, dried, and afterwards soaked in plenty of water for twelve or fifteen hours. Before placing in the camera, it is washed over with a solution containing nitrate of silver and acetic acid in the proportion of about one-tenth of that used in Mr. Talbot's formula, gallic acid being omitted. When removed from the camera, the picture is brought out by dilute gallic acid without heat. When sufficiently developed immerse in water ten or fifteen minutes, then apply the hyposulphite soda, of the strength of one ounce in a pint and a half water, and wash carefully, as before directed.

Papers that have undergone repeated washings are liable to become rough and to have the pile raised. Mr. Brodie recommends that such proofs should be placed between two or three sheets of highly glazed paper, and rubbed well over with a smooth ivory paper knife, by which means the paper will again acquire a fine surface. The same gentleman has suggested a very elegant method of producing the appearance of sky on a positive picture, which is often wanting from that part of the negative having become entirely and equally darkened. By laying a piece of black paper over the picture when taken from the printing frame, and gradually moving it downwards from the top, a nice gradation of tone is produced, which gives a fine effect to the picture.

Process of M. Blanquart Evrard.

M. Blanquart thinks that the inconstant and defective results of the photographic processes on paper, may be traced to an incomplete

and too superficial preparation. His plan of procedure is somewhat like that of Mr. Brodie, and may be briefly stated as follows:— 1st. Take paper suitable for negatives, and having marked it, lay it on the surface of a solution of 30 grains nitrate silver in 900 grains distilled water, taking care that it touches in every part. Let it remain floating for one minute, then take it out, letting it drain from one of the corners, and lay it flat on an impermeable surface, such as a piece of oil-cloth, and let it dry slowly, taking care not to let the fluid settle in places which will produce stains. 2nd. Plunge the paper, the silvered side downwards, in a bath of 25 grains iodide potassium, and 1 grain bromide of potassium, in 560 grains water, for a minute and a half, or two minutes if the weather be cold. Withdraw it, taking it up by the two corners, and pass it, with as little disturbance as possible, into a trough filled with distilled water, to wash away any salts which may have been deposited in the paper; when well washed, hang it up to dry. This paper will last some months; the remainder of the liquids may be put into bottles covered with black paper, and preserved for future use. 3rd. When about to take a picture, spread upon a piece of very flat glass, kept horizontal by a support with screws, a few drops of the following solution, viz., 60 grains nitrate of silver, 110 grains acetic acid, 640 grains distilled water. Dissolve the nitrate silver in half the water and add the acetic acid; leave the mixture one hour, and then add the remainder of the water. This preparation must be kept in a well stoppered bottle, and should it become thick, must be carefully filtered before using. Lay the paper on the glass, the prepared side downwards, and pass the hand over it, so that, having thoroughly imbibed the solution, it will perfectly adhere to the glass without leaving creases or air-bubbles. This done, cover it with one or two sheets of thick clean paper damped with distilled water; cover this with a second glass of the same dimensions as the first, and press them close together. Now place them in the camera frame and expose to the light. The time of exposure depends upon the degree of light, and also upon the temperature; experience will best guide the operator. 4th. The paper being removed from the camera, is placed upon a glass or porcelain slab, slightly moistened that it may adhere easily. Pour on it a saturated solution of gallic acid, and the image will immediately appear. Let the gallic acid act until all the half-tints are fully developed, stopping it before the whites begin to change. 5th. Wash the picture by pouring

water over it, to get rid of the gallic acid. 6th. Then putting it again on the horizontal glass, pour upon it a solution 60 grains bromide potassium to 2400 grains water, letting it remain about one quarter of an hour, keeping it always covered. 7th. Wash it in plenty of water, and dry with blotting paper. Other proportions than those above may be used, if the general principles involved in the process as there stated be adhered to. If the paper is placed between two glasses, as here recommended, care must be taken that the ground glass of the camera is so adjusted as to receive the image at precisely the same spot as that in which the paper will afterwards be placed.

M. Blanquart makes and uses his positive paper after the following receipt. He recommends a thick paper highly glazed. Pour into a trough a mixture consisting of 180 grains saturated solution of common salt and 600 grains distilled water; mark the paper and let it float for two or three minutes on the surface of the fluid, taking care that it touches everywhere. Dry it thoroughly with blotting paper; then lay it upon another bath containing 60 grains nitrate silver in 300 grains distilled water. Let it remain while a second sheet is floated and dried; let the fluid run off at one of the corners, and lay it to dry upon a piece of oil cloth, or some other impermeable material. When dry, lay it singly in a box; it will keep for ten or fifteen days. The exposure will generally last about twenty minutes in the sunshine, but should be carried to the highest point so that the high lights are not injured. Take it out and lay it in soft water for a quarter of an hour, then in a hyposulphite bath, 100 grains to 800 water. It can now be looked at in the open light, and the change observed; if properly done, it will at last obtain a blackish tint. To get rid of the hyposulphite, wash it well, and leave it in a large vessel of water for five or six hours at least, drying it with blotting paper. Several proofs may be put into the hyposulphite bath at the same time, and if the picture is well developed and washed, it may remain there at least two hours without injury.*

The following observations on the Calotype process have been kindly furnished to us by Mr. Hazel.

Good calotype paper may be prepared by either of the foregoing processes, but the novice often complains of the tediousness of the

* Condensed from M. Lerebour's pamphlet entitled "Les Papiers Photographiques."

former, and of uncertainty in effect. The following hints and modifications may not be undeserving of notice.

Provide a piece of deal board, of the width of the paper to be prepared, and six or eight feet in length. Pin the paper to this board with bone pins to its entire length, letting the edge of each piece underlap the foregoing one about one-eighth of an inch. Place the board in an inclined position, and with a flat, soft, broad brush, lay on the first solution of nitrate of silver, beginning at the top and proceeding carefully and lightly downwards, taking all precaution that the entire surface of the paper be evenly and thoroughly covered. Now incline the board with its edge downwards that the superfluous moisture may run off, and so leave the paper to drain and dry. As soon as it is quite dry lay on the solution of iodide of potash in the same manner; when the paper is again about half dry, it must be taken off the board and dipped into or floated on water, taking care that no air bubbles intervene between the prepared side of the paper and the water. It may remain in the water for any period varying from five minutes to five hours; the only difference is that if it remains but the shorter period, it will be rather more sensitive, but will not keep so long uninjured. After this soaking, the paper should be fastened with a pin by one corner to some projecting wood or shelf, and suffered to drain dry, and then put away for use.

The whole of this process should be conducted in a *dark cool room. The flame of the candle or lamp must be covered with a yellow glass shade,* for if white light is used, or if the paper be dried by the fire, the operator will be mortified to find in the end a stained photograph, which he will be at a loss to account for. Neither in this or in any subsequent part of the proceeding should the paper be touched, either by *wiping, or with blotting-paper,* for such would disturb the surface and leave false markings which will afterwards appear.

Before placing in the camera it is more economical, as well as convenient, to use the solution of nitrate of silver in the first place only, and reserve the gallic acid for bringing out the impression. The gallic acid solution should, when used, be mixed with one-half gum water, which will prevent its sinking so deeply into the paper, and allow it to wash off freer. A saturated solution of sulphate of iron employed the same way will bring out the impression equally well with that of gallic acid, with this advantage that the picture fixes with rather more certainty.

Paper photographs possess the advantage of being cheaply procured and of giving any number of copies without the aid of the engraver; but are not equal in sharpness and beauty of delineation to the impressions received by the metallic of plates of Daguerreotype. Operators are well aware that the calotype suffers considerably after it is taken from the camera by the subsequent processes of washing, fixing, and transferring, and perhaps the inferiority will remain until some more suitable material can be found whereon to receive the negative picture. The surfaces of ivory, horn, skin, and Indian rubber, become with the same preparation equally sensitive with paper. Thin horn, such as is used by the lanthorn makers, is an admirable substance whereon to impress the negative picture, and very superior specimens have been procured upon it. The finest lines were not in the least disturbed by washing or rubbing, and from its semi-transparency it promised to yield equally good positive pictures; but there is a difficulty of obtaining it sufficiently free from veins and spots. Whenever horn is used, it must be placed in the camera between two pieces of plate-glass, otherwise it will warp in drying.

Positive Pictures.

Many attempts have been made to produce positive calotype pictures by a single process, but the methods proposed are all difficult of execution, and rarely successful.

Mr. Hunt has recommended the following process as giving very satisfactory results in copying engravings, leaves, etc., though it is hardly sensitive enough for the camera. We have somewhat abridged Mr. H.'s directions.

Good letter paper is soaked for five or ten minutes in a solution of forty grains muriate of ammonia, or muriate of baryta, in four ounces water. Each sheet is carefully removed from the fluid, placed on a glass or porcelain slab, wiped over with a very clean linen rag, and then hung up to dry. When dry, the paper, pinned by its four corners to a board, is washed with the following solution:—One hundred and twenty grains crystallised nitrate silver are dissolved in twelve fluid drachms distilled water and four fluid drachms alcohol added to it. This renders the solution opaque, but after a few hours it grows clear, and a minute quantity of a black precipitate falls, which must be separated by filtering

through white blotting-paper. This solution is applied with a very soft sponge-brush over one surface, care being taken that the fluid is equally diffused over every part of the paper, and that this is done without applying the brush a second time to any portion of the surface. The wet paper is now exposed, without delay, to bright sunshine,—the paper should only be prepared on bright days,—when the solar rays instantly darken the paper. The darkening often proceeds unequally at first, but a second application of the nitrate of silver, before the paper becomes hard and a renewed exposure to sunshine, will remedy this defect. The paper has now an uniform surface of a fine chocolate brown colour. It is now to be dried quickly in the dark, and preserved for use between blotting-paper.

The bleaching fluid is made as follows:—Thirty grains iodide of baryta are dissolved in an ounce of water; to this is added a single drop of sulphuric acid, by which some baryta is separated as a sulphate, and some free hydriodic acid is liberated and remains in the fluid. To use the paper in the camera, wash it over with this solution, and place the paper, carefully spread on a glass plate, wet in the camera. It is important that the wet paper should not be placed upon wood or any carbonaceous body, as in that case a peculiar blackening instead of bleaching will take place. Paper thus prepared is not very sensitive, and an exposure of from twenty minutes to half an hour will be required. The results, however are very beautiful. To copy engravings, the print must first be soaked in water, by which it is rendered transparent and protected from injury by the chemicals in the photographic paper. It is then laid out smoothly upon the glass of the copying-frame and the dark surface of the hydriodated paper pressed very closely against the face of the picture. Thus arranged it is exposed to good sunshine, and allowed to remain until the uncovered portion of the paper which rapidly bleaches begins again to turn brown. The paper being removed is placed in clean water, to dissolve the hydriodate, after which the picture is rendered permanent by fixing with hyposulphate soda. Botanical specimens, etc., are treated in a similar manner.

The following plan was introduced by Professor Grove, at the meeting of the British Association held at York. The above paper, or ordinary calotype paper, is darkened until it assume a deep brown colour, almost amounting to black; it is then re-dipped into the ordinary solution of iodide of potassium and dried. When required for

use, it is drawn over dilute nitric acid, one part acid to two-and-a-half parts water. In this state, those parts exposed to the light are rapidly bleached, while the parts not exposed remain unchanged. It is fixed in the usual method. Mr. Grove brought forward, on the same occasion, another process, by which a negative calotype was converted into a positive one. An ordinary calotype picture is to be taken in the camera and developed by gallic acid, then drawn over iodide of potassium, and dilute nitric acid, and exposed to full sunshine: while bleaching the dark parts, the light is re-darkening the newly precipitated iodide in the lighter portions, and thus the negative picture is converted into a positive one.

These processes are, as we have said, difficult to manage successfully; and the resulting pictures have, though more minutely defined, and free from many defects inherent to copies through paper, the same disadvantages as those of the Daguerreotype, viz. the positions are reversed, and the copies cannot be multiplied.

A good negative picture having been obtained and carefully set, copies may be procured on almost any kind of photographic paper. The following are the formulas for making the papers commonly used for the purpose. The Energiatype paper, which is also very suitable, is described further on. *

1. Mr. Fox Talbot's Photographic Paper.—Take a sheet of good paper, and having dipped it for a minute or so in a solution of common salt, one part of saturated solution to eight parts of water, dry it first in blotting paper, and then spontaneously. Wash one of the sides, previously marked, with a solution of nitrate of silver—eighty grains to one ounce of distilled water. Allow it to dry, and it is ready for use.

An improved Paper of this description may be made by using the following proportions:—25 grs. salt to 1 oz. of water, and 100 grs. nitrate silver to 1 oz. water. Wash the paper with the first solution by a sponge brush, and when dry lay on the silver solution with a large camel's hair pencil. The salt may be replaced by 20 grains muriate ammonia, or by from five to 25 grains muriate of baryta. The different substances and different strengths of the solutions will beautifully vary the tint of the picture produced.

* Photogenic Paper, of various kinds, may be obtained of Messrs. T. & R. Willats, 98, Cheapside.

Mr. Cundell's Paper.—To a solution of one drachm of nitrate silver, in twelve drachms of water, add strong ammonia, till the precipitate which falls is just re-dissolved. Wash the marked side of the paper over with this solution, then dip it in water containing forty grains common salt to the pint; apply the nitrate of silver solution as before, and dry carefully in the dark. It is better to leave a little oxide of silver in the ammoniacal solution rather than to add too much ammonia.

3. Mr. Cooper's Paper.—Soak the paper for a few minutes in a boiling solution of chlorate of potash, (the strength is immaterial;) dry it, and wash it on one side with a solution of nitrate of silver, sixty grains to the ounce of distilled water. This paper is not very sensitive, but the image can be fixed by washing only.

4. M. Daguerre's Paper.—Immerse the paper in hydrochloric (muriatic) ether, which has become acid from keeping; the paper is then carefully and completely dried. It is then dipped into a solution of nitrate of silver, and dried without artificial heat in a perfectly dark room. This paper is very sensitive when quite new, but gradually loses its impressionability.

5. Bromide Paper.—Dissolve 100 grains bromide potassium in one ounce distilled water, and soak the paper in this solution. Take off the superfluous moisture, and when nearly dry brush it over on one side only with a solution of 100 grains nitrate of silver to one ounce of water. This paper is readily prepared, and tolerably sensitive. If required to be very sensitive, it should be brushed over a second time with the nitrate of silver.

These papers really vary very little from each other, and we should recommend Nos. 1, 2, and 5. The same general rules must be observed in the preparation of each. They must all be dried in the dark after the nitrate of silver has been used. If the paper is brushed over, the brush must be large and broad, so that the whole of the sheet may be wetted in two or three sweeps, otherwise marks will appear in the paper corresponding to the lines made by the brush. If blotting paper is required, it must be frequently changed, and never used for two different preparations.

A sheet of either of the above papers may be taken and laid with the marked side upward, on a piece of board covered with flannel: on this paper must be laid the negative picture, with its face downwards, and over both a piece of plate glass, the glass and board being tightly presed together by screws or weights. The frame described, page 5, is a most convenient apparatus for this purpose. It must now be exposed to light, in about ten or fifteen minutes of bright sunshine, or in several hours of common daylight, a beautiful positive picture is produced, in which the lights and shadows are corrected. These pictures have a fine effect, though they lose somewhat of their sharpness in passing through the copy. They may be set with hyposulphate of soda, as directed for the *negative* pictures. If the negatives are clear, and the shadows dark, a great many copies may be obtained from them.

We may mention here, that copies of PRINTS, FEATHERS, LACE, etc., are obtained in the same manner as the positive pictures just described; and where it is necessary to reverse them afterwards, as in the case of prints, the process must be gone through twice; that is, a strong negative picture must be first obtained, and then positive copies must be got by printing from it. Beautifully accurate copies of a vast variety of objects may be procured in this way.

Some observations on this subject, which will be found under the head of ENERGIATYPE, will perhaps assist the operator.

Both negatives and positives are much improved by placing them under a sheet of highly glazed paper, and then polishing with a steel burnisher.

CATALYSOTYPE.

This process was introduced by Dr. Thomas Woods, of Ireland, and has been practised with some success. It is desirable to use unglazed copy paper for this process, or if highly glazed writing paper is used, it should be steeped in water to which hydrochloric acid has been added; two to three drops to three ounces water is sufficient, and this makes the paper imbibe the solutions equally. It is then brushed over with a solution consisting of syrup of ioduret of iron and distilled water each two drachms, tincture of iodine ten to twelve drops. When this has remained on the paper for a few minutes, so as to be imbibed, dry it

lightly with bibulous paper, and then, in a dark room, wash it over evenly by a camel's-hair pencil with a solution of nitrate silver, sixty grains in an ounce of distilled water. The colour should now be of a canary yellow; it is ready for the camera, and should be used as soon as possible. The time of exposure varies from two to thirty minutes. When the paper is removed from the camera no picture is visible, but when left in the dark a negative picture is gradually developed until it attains a great perfection. The bringing out may be hastened by the use of the Photographic Etna, described page 9. The picture is fixed by washing in water, then soaking for a few minutes in a solution of iodide potassium five grains to the ounce, and finally washing again in water.

"If," says Dr. Woods, "the acid solution," used to prepare glazed paper, "be too strong, it produces the very effect it was intended to overcome; that is, it produces yellow patches, and the picture itself is of a light brick colour on a yellow ground. When the tincture of iodine is in excess, partly the same results occur, shewing that the oxide of silver which is thrown down in both cases is re-dissolved by the excess of acid and iodine, and their quantities should be diminished. On the contrary, if the silver solution be too strong, the oxide is deposited in the dark, or by an exceedingly weak light, and in this case blackens the yellow parts of the picture, which destroys it. When this takes place, the silver solution should be weakened. If it be too weak, the paper remains yellow after exposure to light. If the ioduret of iron be used in too great a quantity, the picture is dotted over with black spots which afterwards change to white."

The following formula has been given for preparing the syrup of ioduret of iron:—Take of dry iodine 200 grains; fine iron wire, recently cleaned, 100 grains; white sugar in powder 4½ ounces; distilled water 6 ounces. Boil the iodine iron and water together in a glass mattrass, at first gently, to avoid the expulsion of iodine vapours: afterwards briskly, until about two fluid ounces of liquid remain. Filter this quickly, while hot, into a flask containing the sugar; dissolve the sugar with a gentle heat, and add, if necessary, distilled water to make up six fluid ounces.*

* Correspondent of "The Magazine of Science."

ENERGIATYPE.

The process which Mr. Hunt has designated the Energiatype, is one of the simplest and most convenient modes of obtaining photographic pictures; and the public are much indebted to this gentleman for the prompt and handsome manner in which he communicated his discovery through the pages of the 'Athenæum.'

"While pursuing," he says, "some investigations, with a view to determine the influence of the solar rays upon precipitation, I have been led to the discovery of a new photographic agent, which can be employed in the preparation of paper, with a facility which no other sensitive process possesses. Being desirous of affording all the information I possibly can to those who are anxious to avail themselves of the advantages offered by photography, I solicit a little space in your columns for the purpose of publishing the particulars of this new process. All the photographic processes with which we are at present acquainted, sufficiently sensitive for the fixation of the images of the camera obscura, require the most careful and precise manipulation; consequently, those who are not accustomed to the niceties of experimental pursuits, are frequently annoyed by failures. The following statements will at once shew the exceeding simplicity of the new discovery."

Here follows, in the original letter, the description of the process as then employed. We shall, however, introduce it to the amateur with such modifications as the experience of Mr. Hunt himself, and other gentlemen who have adopted the method, have suggested to us.

Preparations of the Paper.—Good letter paper, Whatman's, or Moinier's pure white is best, is first washed over with the following solution, viz. five grains succinic acid, dissolved in one fluid ounce water, to which is added about five grains common salt, and half a drachm mucilage gum arabic. When dry, the paper is drawn over the surface of a solution of sixty grains of nitrate silver in one ounce of distilled water. Allowed to dry in the dark the paper is now fit for use, is of a pure white, retains its colour, and may be preserved for a considerable time in a portfolio, until wanted for use.

The preparation of this paper is by no means difficult, but requires

much care and attention. The solutions must be applied very equally over the paper, which should be immediately hung upon a frame or clothes' horse to dry. Extreme care must be taken that the paper be not exposed to light, after the nitrate of silver solution has been applied, until required for use. Many of the disappointments experienced by the experimenters on the Energiatype are occasioned by a neglect of this precaution; as, although no apparent effect may have been produced by the exposure, the clearness of the subsequent picture will be seriously injured. The succinic acid must also be very pure. In the general way it will be found more convenient, and perhaps economical, to purchase the paper ready prepared. We shall now briefly describe the method of applying the Energiatype to the different purposes for which it is best adapted, premising that the varying circumstances of time, place, and light, will render necessary such modifications of the following directions as the experience of the operator may suggest. As a general rule, an open situation, sunshine, and, if possible, the morning sun, should be preferred, as the image is sharper, and the colour produced more intense and less affected by the subsequent fixing process.

NEGATIVE PICTURES.

In the Camera.—For a building, an exposure of half a minute in strong sunshine is usually sufficient; for a portrait, which can only be taken in the shade, two or three minutes is required. Directions for placing the camera, sitter, etc., etc., will be found under the Calotype process, at page 13.

Exact copies of prints, feathers, leaves, etc., may be taken, by exposing them to the light in the copying-frame, described p. 7, until the margin of the prepared paper, which should be left uncovered, begins to turn very slightly. If the object to be copied be thick, the paper must be allowed to assume a darker tint, or the light will not have penetrated it.

It has been found by experiment, that the sulphate of iron has the property of developing the latent images on papers prepared with other salts of silver, and that by using the acetate bromide, benzoate, etc., the most varied and beautiful effects are elicited.

The calotype picture may, it is said, be developed in this way after an exposure of one or two seconds only.

CHRYSOTYPE.

Sir John Herschel, whose various experiments have done so much for the art of Photography, is the discoverer of this process, and that of the Cyanotype, of which we shall next speak. They are both founded upon the use of the salts of iron as photographic agents. The Chrysotype process was communicated to the Royal Society in June, 1843, and is as follows:—

Paper is washed over with a moderately concentrated solution of ammonia-citrate of iron, and dried,—the strength of the solution being such as to dry into a good yellow colour, and not at all brown. In this state it is ready to receive a photographic image, which may be impressed on it, either from nature in the camera obscura, or from an engraving in a frame in sunshine. The image so impressed, however, is faint, and sometimes hardly perceptible. The moment it is removed from the camera, it must be washed over with a neutral solution of gold, of such strength as to have the colour of sherry wine. Instantly the picture appears; not, indeed, at once with its full intensity, but darkening rapidly up to a certain point. At this point nothing can surpass the sharpness and perfection of detail of the resulting photograph. The picture is now to be rinsed in spring water, which must be three times renewed. It is then blotted and dried, after which it is to be washed on both sides with a somewhat weak solution of hydriodate of potash. After being again rinsed and dried, it is now perfectly fixed. If the nitrate of silver be used instead of the solution of gold, the picture is brought out, but more slowly and with much less beauty.

CYANOTYPE OR FERROTYPE.

This name has been given, by Sir John Herschel, to several processes in which cyanogen is used in combination with iron. The term Ferrotype, which is sometimes applied to them, may with more propriety designate the whole of those photographic processes, a numerous class, in which iron may be employed as the developing agent.

First Process.—The paper is washed over, as in the Chrysotype, with a solution of ammonia citrate of iron. It is now exposed to light, and a latent picture impressed upon it. If the paper has sensibly

darkened, the picture will appear negative. It is now brushed over very sparingly and equally with a solution of the ferro-cyanate potash, in which is dissolved a little gum arabic. The negative picture quickly vanishes, and is more slowly replaced by a positive one of a violet blue colour, on a greenish yellow ground. If when dry the details are not sufficiently distinct, a second wash will generally bring out the picture, which should be beautiful and sharp.

Second Process.—A paper is prepared with a mixture of equal proportions of ammonia-citrate iron and ferro-sesquicyanate of potash. When a picture has been impressed, it is thrown into water and dried, and a negative picture results. If this picture is washed with a solution of the proto-nitrate mercury, it is readily discharged, but is susceptible of restoration by thoroughly washing out the mercurial salt, and drying the paper. A smooth iron, rather hot, but not sufficiently so to scorch the paper, is now passed over it, and the obliterated picture immediately re-appears, but of a brown tint. These photographs gradually fade and disappear, but may be again restored by the application of heat.

Third Process.—One part by weight of ammonia-citrate of iron is dissolved in eleven parts of water, and this is mixed with an equal quantity of saturated cold solution of bichloride mercury. Before a precipitate has had time to form, the solution is brushed over paper, which should have a yellowish rather than a bluish cast, and dried. This paper keeps well, and when used is exposed to light, until a faint but perfectly visible picture is impressed. It is then brushed over as rapidly as possible with a saturated solution of prussiate of potash, diluted with three times its bulk of gum water, so strong as just to flow freely without adhesion to the lip of the vessel. The wash must be spread with one application, evenly and very quickly, over every part of the paper. It is fixed by drying. Beautiful positive pictures are thus produced, which will bear immediate exposure tolerably well, but which after a few days will bear strong sunshine uninjured. If the impression be overdone, the darker shades will disappear: if too little, the whole runs into blot. The exact time of exposure can only be learnt by practice.

There are several other varieties of these processes, which are not

sufficiently important to be included here: the formula may be seen by reference to Sir John Herschel's Papers in the 'Philosophical Transactions.' The following process, communicated by him to the British Association in 1843, is, however, so curious, that we are induced to insert it here. If nitrate of silver, specific gravity 1.200, be added to ferro-tartaric acid, specific gravity 1.023, a precipitate falls, which is in a great measure re-dissolved by a gentle heat, leaving a black sediment, which, being cleared by subsidence, a liquid of a pale yellow colour is obtained, in which a further addition of the nitrate causes no turbidness; when the total quantity of the nitrated solution added, amounts to about half the bulk of the ferro-tartaric acid, it is enough.

The liquid so prepared does not alter by keeping in the dark. Spread on paper and exposed wet to sunshine (partly shaded) for a few seconds, no impression seems to have been made; but by degrees, although withdrawn from the light, it develops itself spontaneously, and at length becomes very intense. But if the paper be thoroughly dried in the dark, (in which state it is of a very pale greenish yellow colour,) it possesses the singular property of receiving a dormant or invisible picture; to produce which (if it be, for instance, an engraving that is to be copied) from thirty seconds to a minute's exposure in the sunshine is requisite. It should not be continued too long, as not only is the ultimate effect less striking, but a picture begins to be *visibly* produced, which darkens spontaneously after it is withdrawn. But if the exposure be discontinued before this effect comes on, an invisible impression is the result, to develope which all that is necessary is to breathe upon it, when it immediately appears, and very speedily acquires an extraordinary intensity and sharpness, as if by magic. Instead of the breath, it may be subjected to the regulated action of aqueous vapour, by laying it in a blotting-paper book, of which some of the outer leaves on both sides have been damped, or by holding it over warm water.

CHROMOTYPE.

M. Ponton was the first to point out the photographic properties of bichromate of potash. His process for preparing paper is as follows:— Immerse a well-sized paper in a saturated solution of bichromate potash, and dry by the fire. It is of a fine yellow colour, and keeps well in the

dark. When exposed to the rays of the sun, it becomes of a light brown; and if an engraving has been placed upon it, the resulting picture is negative. It is fixed by soaking in water. Mr. E. Becquerel improved upon this process by applying evenly over the paper a sizing of starch, and then steeping it in the bichromate solution as before. The picture having been taken, and the paper washed and dried, it is immersed in a weak alcoholic solution of iodine, in which it remains some time, and is then rinsed and carefully dried between blotting-paper, without much heat. When wet, the shades of the picture are of a fine blue; but when dry, of a deep violet. If the picture, while wet, is covered with a coating of gum, the colour is better preserved, and is more beautiful when dry.

Mr. Hunt announced the process, which is termed the Chromotype, at the meeting of the British Association in 1843. It is not sufficiently sensitive for the camera, but is valuable for copying engravings, etc. Good writing paper is washed over with sulphate of copper, in solution, about one drachm to an ounce of water; when dry, it is again washed with a strong, but not saturated, solution of the bichromate of potash, and again dried. The paper may be preserved in this state for a considerable time. When exposed to sunshine, it changes to a dull brown, and if checked here, a negative picture is produced; but if the action of light is continued, the browning gives way, and the picture becomes positive,—yellow on a white ground. From five to twenty minutes is usually required to produce the effect. In either case, if the picture be washed over with a solution of nitrate of silver, a very beautiful positive picture results. To fix the picture, wash it immediately in pure water, and dry it. If the water contains any muriates, the picture suffers, and long soaking entirely destroys it. When a few grains of common salt are added to the water, a curious effect is produced: the picture is apparently rapidly destroyed, but may be restored by an exposure to the sun of from ten minutes to a quarter of an hour, and is now of a lilac colour,—the shades depending on the quantity of salt used. No fresh process is required to fix it.

A beautiful variety of the Chromotype is thus described by Mr. Hunt. "A neutral solution of the chloride of gold is mixed with an equal quantity of the bichromate of potash. Paper is washed with this solution, and dried near the fire. On exposing this paper to light,

it speedily changes, first to a deep brown, and ultimately to a bluish black. If an engraving is superposed, we have a negative copy, blue or brown, upon a yellow ground. If this photograph is placed in clean water, and allowed to remain in it for some hours, very singular changes take place. The yellow salt is all dissolved out, and those parts of the paper left beautifully white. All the dark portions of the paper become more decided in their character, and accordingly as the solarization has been prolonged or otherwise, or the light has been more or less intense, we have either *crimson, blue, brown, or deep black photographs of a most beautiful character.*"*

AMPHITYPE.

This is another of the interesting and valuable discoveries of Sir John Herschel. It was given to the public at the last meeting of the British Association, and is described by him as follows:—

Paper, proper for producing an amphitype picture, may be prepared, either with the ferro-tartrate or the ferro-citrate of the protoxide or the peroxide of mercury, or of the protoxide of lead; by using creams of these salts, or by successive applications of the nitrates of the respective oxides, singly or in mixture, to the paper, alternating with solutions of the ammonia-tartrate or ammonia-citrate of iron,† the latter solutions being last applied, and in more or less excess. I purposely avoid stating proportions, as I have not yet been able to fix upon any which certainly succeed. Paper so prepared and dried takes a negative picture, in a time varying from half an hour to five or six hours, according to the intensity of the light; and the impression produced varies in apparent force from a faint and hardly perceptible picture, to one of the highest conceivable fulness and richness, both of tint and detail, the colour in this case being a superb velvety brown. This extreme richness of effect is not produced except lead be present, either in the ingredients used, or *in the paper itself*. It is not, as I originally supposed, due to the presence of free tartaric acid. The pictures in this state are not permanent.

* Researches on Light, by Robert Hunt, 1844.

† So commonly called, and sold as such; but as I am disposed to regard their composition, their chemical names would be ferro-tartrate and ferro-citrate of ammonia.

They fade in the dark, though with very different degrees of rapidity, some (especially if free tartaric or citric acid be present) in a few days, while others remain some weeks unimpaired, and require whole years for their total obliteration. But though entirely faded out in appearance, the picture is only rendered dormant, and may be restored, changing its character from negative to positive, and its colour from brown to black (in the shadows) by the following process:—A bath being prepared by pouring a small quantity of solution of pernitrate of mercury into a large quantity of water, and letting the sub-nitrated precipitate subside; the picture must be immersed in it, (carefully and repeatedly clearing off all air bubbles,) and allowed to remain till the picture (if anywhere visible) is entirely destroyed, or if faded, till it is judged sufficient from previous experience—a term which is often marked by the appearance of a feeble positive picture, of a bright yellow hue, on the pale yellow ground of the paper. A long time (several weeks) is often required for this, but heat accelerates the action, and it is often complete in a few hours. In this state the picture is to be very thoroughly rinsed and soaked in pure warm water, and then dried. It is then to be well ironed with a smooth iron, heated so as barely not to injure the paper; placing it, for better security against scorching, between smooth clean papers. If then the process has been successful, a perfectly black positive picture is at once developed. At first it most commonly happens that the whole picture is sooty or dingy to such a degree that it is condemned as spoiled; but on keeping it between the leaves of a book, especially in a moist atmosphere, by extremely slow degrees this dinginess disappears, and the picture disengages itself with continually increasing sharpness and clearness, and acquires the exact effect of a copper-plate engraving on a paper more or less tinted with pale yellow. I ought to observe that the best and most uniform specimens which I have procured, have been on paper previously washed with certain preparations of uric acid, which is a very remarkable and powerful photographic element. The intensity of the original negative picture is no criterion of what may be expected in the positive. It is from the production, by one and the same action of the light, of either a positive or a negative picture, according to the subsequent manipulations, that I have designated the process thus generally sketched out, by the term *amphitype*,—a name suggested by Mr. Talbot, to whom I communicated this singular result; and to this process, or class

of processes, (which I cannot doubt when pursued will lead to some very beautiful results,) I propose to restrict the name in question, though it applies even more appropriately to the following exceedingly curious and remarkable one in which silver is concerned. At the last meeting I announced a mode of producing, by means of a solution of silver, in conjunction with ferro-tartaric acid, a dormant picture brought out into a forcible negative impression by the breath or moist air. The solution then described, and which had, at that time, been prepared some weeks, I may here incidentally remark, has retained its limpidity and photographic properties quite unimpaired during the whole year since elapsed, and is now as sensitive as ever,—a property of no small value. Now, when a picture (for example, an impression from an engraving) is taken on paper washed with this solution, it shows no sign of a picture on its back, whether that on its face be developed or not; but if, while the actinic influence is still fresh upon the face, (*i. e.* as soon as it is removed from the light,) *the back* be exposed for a very few seconds to the sunshine and then removed to a gloomy place, a *positive picture, the exact complement of the negative one on the other side*, though wanting of course in sharpness if the paper be thick, *slowly and gradually makes its appearance* there, and in half an hour or an hour acquires a considerable intensity. I ought to mention that the "Ferro-tartaric" acid in question is prepared by precipitating the ferro-tartrate of ammonia (ammonia-tartrate of iron) by acetate of lead, and decomposing the precipitate by dilute sulphuric acid.

P. S. When lead is used in the preparation of Amphitype paper, the parts on which the light has acted are found to be in a very high degree *rendered waterproof*.

ANTHOTYPE.

The influence of light upon the growth and germination of plants is very curious and interesting. The facts connected with this subject have been investigated by Mr. Chevreul, Mr. Hunt, and Sir John Herschel. To the latter gentleman we are indebted for the inquiries which have led to the publication of the Anthotype process. He found that the expressed juices, and alcoholic or watery infusions of certain

flowers, more particularly the papaver rhœas, the coschoous japonica, the violet, rose, ten weeks' stock, etc., etc., when spread on paper, were very sensitive to light. To procure this colouring matter, the petals of fresh and well-selected flowers are bruised to a pulp in a marble mortar, either alone or with the addition of a small quantity of alcohol,—the juice is expressed by squeezing the pulp through a piece of fine linen. The paper is prepared in the following manner:—"The paper should be moistened on the back by sponging and blotting off. It should then be pinned on a board, the moist side downwards, so that two of its edges (suppose the right hand and lower one) shall project a little beyond those of the board. The board being then inclined twenty or thirty degrees to the horizon, the alcoholic tincture (mixed with a very little water, if the petals themselves be not very juicy) is to be applied with a brush, in strokes from left to right, taking care *not to go* over the edges which rest on the board, but to pass clearly over those that project; and observing also to carry the tint from below upwards by quick sweeping strokes, leaving no dry spaces between them, but keeping up a continuity of wet spaces. When all is wet, cross them by another set of strokes from above downwards, so managing the brush as to leave no floating liquid on the paper. It must then be dried as quickly as possible over a stove, or in a current of warm air, avoiding, however, such heat as may injure the tint." If alcohol has not been added, the extract must be applied to the paper immediately. Most of the papers so prepared require an exposure of many days, from twenty to thirty, to produce a decided effect, and the pictures obtained are not always permanent. This will of course preclude their being of practical utility: but the changes produced are so remarkable, that we could not, with propriety, omit mentioning them. A full account of Sir John Herschel's experiments will be found in his Memoir, or "The Action of the Rays of the Solar Spectrum on Vegetable Colours," etc., published in the second part of the Philosophical Transactions for 1842.

Similar effects are produced by light in the gums, resins, and residua of essential oils, when thin films are spread upon paper or on metal plates. A paper prepared with an alcoholic solution of guaiacum, and placed in an aqueous solution of chlorine, acquires a beautiful blue colour; it is very sensitive, and may be used for copying engravings, the resulting picture penetrating the paper, and appearing on the back with almost the same intensity as on the face. The images, however, speedily fade.

COLORING PAPER PHOTOGRAPHS.

A very good effect may be produced by tinting the sun pictures, but the artist must select his colors with judgment, so that the pigment employed shall not, while in a moistened state, act upon the salts in the paper, or be acted upon by them. By the use of the colored French chalks, the appearance of a photograph is much improved; or by stippling on dry colours in the same manner as directed for Daguerreotype pictures in No. 2 Manual.

THERMOGRAPHY.

If a coin be laid on a polished silver plate, and the plate be then gently heated and allowed to cool, an impression will be formed of the coin on its surface, which will become visible on breathing over the plate. The figure will remain for several days, only requiring to be breathed on to become visible, and if the plate be exposed to the vapour of mercury, the impression becomes fixed.

Almost any substance laid upon a polished surface of glass, slightly warmed, will produce an impression when breathed on; the definition of which varies with the substance employed. For instance, a coin allowed to remain on a looking-glass a few minutes, and breathed over three or four times, will, on the coin being removed, be rendered visible for weeks by merely breathing on the surface of the glass, provided it be not rubbed during that time, which would destroy the impression. The same result is produced by exposure to the sun-light for several hours.

THE FLUOROTYPE.

This process, which is characterised by its easy preparation, and the sensibility of the papers when carefully prepared, consists in the formation of a salt of silver, which must be considered as a fluo-bromide of silver. It is difficult to say, which is the best manner of proceeding; but the difference, as it regards the sensibility of papers is so very trifling, that it is not of much importance. The paper is to be washed first with the bromide of potassium, and then

with the fluate of soda; or, which will be found perhaps the best plan, the two salts may be united. The strength of the solutions should be as follows:—

Bromide of potassium	20 grains.
Distilled water	1 fluid ounce.
Fluate of soda	5 grains.
Distilled water	1 fluid ounce.

Mix a small quantity of these solutions when the papers are to be prepared, and wash the paper once over with the mixture, and when dry apply nitrate of silver, in solution, 60 grains to an ounce of water. These papers keep for some weeks without injury, and they become impressed with images in half a minute in the camera. This impression is not sufficiently strong to serve, in the state in which it is taken from the camera, for producing positive pictures, but it may be rendered so by a secondary process.

The photograph is first soaked in water for a few minutes; it is then placed upon a slab of porcelain or glass, and a weak solution of the protosulphate of iron applied, which very quickly darkens, all the parts on which the light has acted, to a dark brown, and every object is brought out with great clearness. When the best effect is produced the process must be stopped. All that is necessary is to soak the paper in water, and then fix the drawing with hyposulphate of soda.

In the preceding pages we have endeavoured to include all the Photographic processes which will be really useful to amateurs. There are many varieties of all these; every successful practitioner having his favourite formula, or modus operandi. To record all those that have been announced to the world during the last two or three years would require a volume, and would confuse rather than direct. We would recommend our readers to acquire a practical acquaintance with such as have been described; and then if they have some chemical knowledge, a small portion of time devoted to the consideration of the general principles upon which they are all conducted, will possibly enable them to introduce divers modifications and improvements. We have already pointed the way to such inquiries in referring to Sir John Herschel's papers in the Philosophical Transactions, and to Mr. Robert Hunt's Researches on Light, which, with a few papers scattered through some of our scientific periodicals, comprise everything of importance that has been written on the subject.

PHOTOGRAPHIC MANUALS, No. II.

PRACTICAL HINTS

ON

THE DAGUERREOTYPE;

BEING

SIMPLE DIRECTIONS FOR OBTAINING PORTRAITS, VIEWS, COPIES OF ENGRAVINGS, DRAWINGS, SKETCHES OF MACHINERY, ETC.

BY THE

Daguerreotype Process;

INCLUDING THE LATEST IMPROVEMENTS IN FIXING, COLOURING, AND ENGRAVING THE PICTURES; WITH A DESCRIPTION OF THE APPARATUS.

Illustrated with Engravings.

SECOND EDITION, WITH ADDITIONS.

BY THE EDITOR OF "PLAIN DIRECTIONS FOR OBTAINING PHOTOGRAPHIC PICTURES," SCIENTIFIC MANUALS, No. I. .

LONDON:

T. & R. WILLATS, OPTICIANS, 98, CHEAPSIDE;

SHERWOOD, GILBERT, & PIPER, PATERNOSTER-ROW;

AND ALL BOOKSELLERS.

(ENTERED AT STATIONER'S HALL.)

1846.

ADVERTISEMENT.

The rapid sale of the first Edition (One Thousand Copies) of this Little Manual, induces the Proprietors to believe, that it has been found a really useful auxiliary in the practice of the Photographic Art. In preparing a new Edition, they have only so far changed the character of the work as to embody in it such modifications of the process as the Editor has himself found to be improvements, and to replace some of the less important portions by matter of greater interest and utility. With these additions and emendations, it is commended to the notice of those who desire clear and simple directions for conducting an operation which, even when divested of all scientific mystery, is sufficiently delicate and difficult.

London, July, 1840.

PRACTICAL HINTS

ON

THE DAGUERREOTYPE.

NOTWITHSTANDING the many valuable discoveries with which the researches of Sir John Herschell, Mr. Fox Talbot, Mr. Robert Hunt, and other distinguished philosophers, native and foreign, have recently enriched the science of Photography, or as it is now termed, Actino-Chemistry,* the Daguerreotype process, first divulged in 1839, still retains the highest place in public estimation. The extreme beauty and delicacy of the pictures produced by this method, and the comparative simplicity and certainty of the operation, fully justify this preference, and account for the large number of amateurs who are pursuing it in the present day, with more or less success. While, however, the process is simple in itself, it requires much care and nicety of manipulation, which is only to be acquired by continued practice, or by the most careful attention to the directions which are given by proficients in the art —and without which the operator is exposed to frequent annoyance and disappointment. It is with the view of providing this necessary assistance, that the following Hints have been thrown together, in which all technicalities have been as much as possible avoided, and the directions made short and plain, so as to be easily understood and followed.

* This term was suggested by Sir John Herschell, and adopted at a Meeting of the British Association, in September, 1844, to indicate that department of Chemistry which is connected with the influence of the solar rays.

The history of this invention is well known: Monsieur Daguerre had for some time devoted his attention to the subject of Photography, particularly to the means of fixing the images obtained in the camera obscura. While pursuing these enquiries in conjunction with his partner, Mr. Niepcéc, he was led to adopt an entirely new process, which, after many years of study and experiment, was produced under the name of the Daguerreotype. The French government, appreciating the utility of the invention, purchased it, granting to M. Daguerre a pension of 6000 francs per annum for his life, and a proportionable sum to M. Isidore Niepcée, the son of his former partner. Since the introduction of the Daguerreotype very many improvements have been introduced, chiefly with a view to increase the sensibility of the plates on which the effect of the light is now, with fine lenses, almost if not quite instantaneous.

As the possession of a good apparatus is an essential attribute of success in taking Daguerreotype pictures, it will be well to begin by describing the various articles which are necessary or convenient for this purpose. They are as follows :—

Camera Obscura.

The Camera Obscura, used for taking Daguerreotype Pictures (Fig. 1,) is a wooden box, furnished in front with a brass tube, in which an achromatic lens is made to slide. The image is received on a piece of ground glass fitted in a frame, which slides in a groove in the back of the camera, and the focus is adjusted by a rack-work in the brass tube of the lens. The frame and glass may be withdrawn, and another frame introduced,—

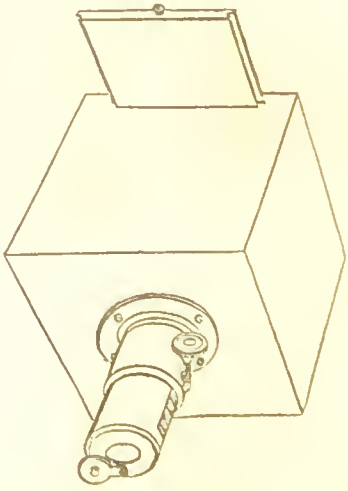
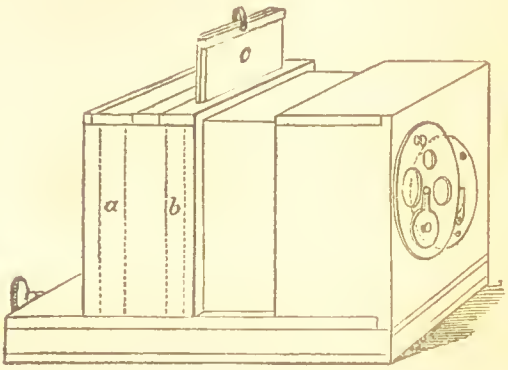


Fig. 1.

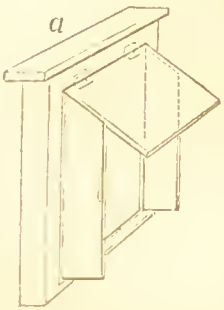
consisting of a wooden back, made to hold the silver plate, and a sliding front, which can be raised when the plate is to be submitted to the action of the rays of light passing through the lens. This camera may be made of any dimensions, according to the diameter of the lens employed.

Willats's Improved Photographic Camera, (Fig. 2,)

Is a great improvement on that just described. The lens, instead of sliding in a brass tube, is bedded in the front of the Camera, by which an increase of light is obtained; the quantity admitted being regulated by a diaphragm, having apertures of different diameter. The back part of the camera slides into the front, and to secure a very accurate adjustment is mounted with a screw. It is moved in or out by turning a small handle at the back. This camera is arranged with two grooves (*a* and *b*,) so as to allow the use of two lenses of different focal powers, according as portraits or views are desired.



The frame with the ground glass (Fig. 3) is furnished with a moveable top and sides, which when extended, exclude the light, and aid the operator in determining the best focus.



The second frame (Fig. 4) consists of a box (*b*) made to receive thin wooden frames adapted to the various sized Daguerreotype plates, which may be placed horizontally or vertically, at pleasure;—this frame is furnished with a sliding door (*c*,) laying over the top of the camera when raised.

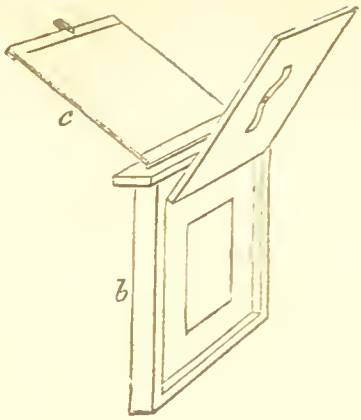


Fig. 4.

These cameras are usually made about 8 inches broad by 6½ high, and will carry a 1 by 3-in. plate.

Improved Camera with Combination Lenses. (Fig. 5.)

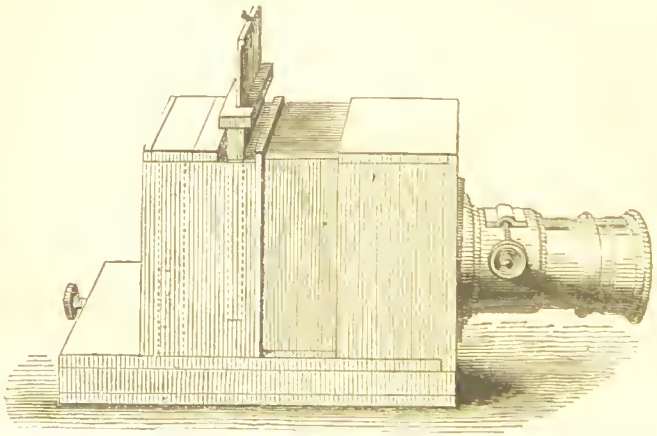


Fig. 5.

The front of this Camera contains a set of double combination lenses, by which arrangement greater nicety of delineation and more rapid action is obtained. A small reflecting mirror is sometimes placed in front, which reverses the objects in the camera, representing them exactly as they appear in nature.

The camera represented, Fig. 6, is a new and very useful article, being made to fold up into the compass of a moderate sized book, and may be carried in the pocket without inconvenience.

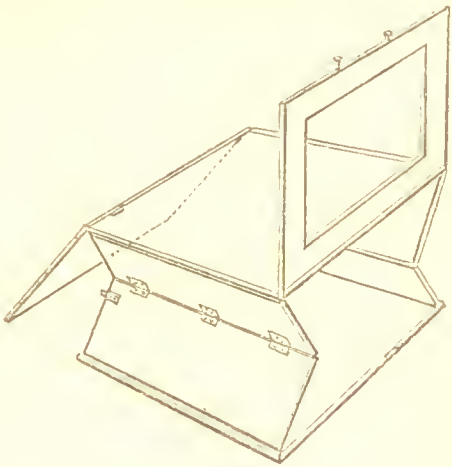


Fig. 6.

It is so arranged as to put together with the utmost ease, and kept securely in its place by a bolt or two in the sides and back.

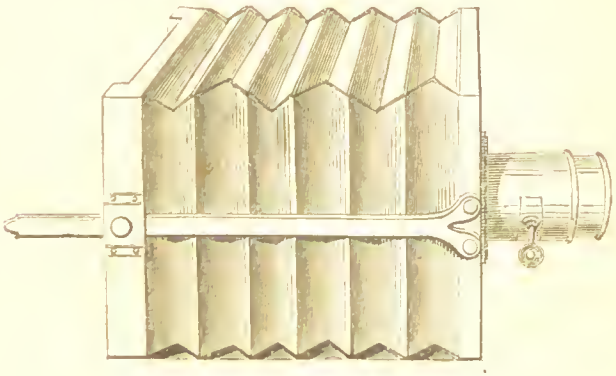


Fig. 7.

Fig. 7 represents another contrivance for rendering the camera obscura more portable; the central part being made of leather, like the bellows of an accordion, may be extended or contracted according to the focus of the lens, and the distance of the object.

DAGUERREOTYPE PANORAMIQUE.

This apparatus is constructed to admit of a view of considerable length and of extreme nicety of delineation, being taken with a lens of moderate diameter. The lens is made to have a horizontal movement, which brings it to bear successively upon every part of the horizon within 150 degrees. Having been fixed, so that the vertical lines of the object are perpendicular, with a line drawn through the ground glass on which the focus is taken. The prepared plate is placed in a flexible frame, and retained in a certain curve, by stops fixed to the frame. The lens is now turned to the extreme limit of the view to be taken, and then gradually and smoothly moved onward by a rackwork attached to the camera, till it reaches the other extremity, waiting a longer or shorter time at each point as the object is more or less illuminated. The plates are prepared and fixed in the ordinary way. The use of this instrument is not so difficult as would be imagined from the description.

Mercury Box.

This is a small box (Fig. 8) supported on two sliding legs, for the sake of portability, having in the bottom an iron cup for holding the mercury, and in the inside a ledge to support the frame and plate. In the front is introduced a piece of glass, protected by a slide, to enable the operator to watch the developement of the picture. A small thermometer is usually added, the bulb of which dips into the iron trough, to enable the operator to observe the temperature of the mercury.

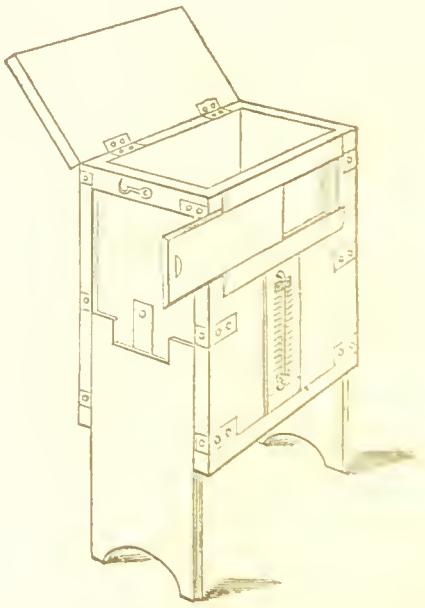


Fig. 8.

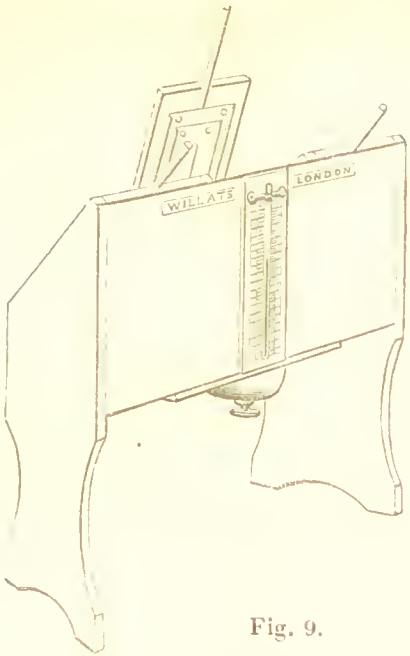


Fig. 9.

A very useful form of mercury box, fig. 9, is made, with divisions for two or more pictures, and with sliding frames to take any size plate; it is furnished with a metal rod, which raises the plate so that the development of the picture may be readily observed. It is used in a dark room, and a lanthorn with a red glass must be employed to inspect the plate.

Iodine and Bromine Troughs, (Fig. 10.)

These are either of glass or Berlin ware, encased in wood; they are furnished with frames of various sizes to hold the plates, and with a cover of slate or glass. They may be used for any of the sensitive solutions.

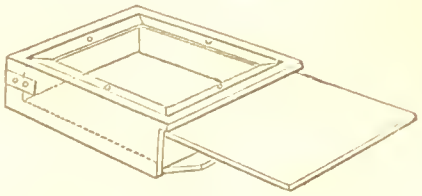


Fig. 10.

Improved Iodine and Bromine Troughs, (Fig. 11.)

These troughs consist of glass pans, much deeper than those repre-

sented in fig. 10; they are enclosed in wooden boxes, such as that in fig. 11, with glass covers which slide on or off at pleasure. On opposite sides of each box are two square apertures, to one of which a small mirror, moving on a hinge, is attached. Frames to suit the various sized plates are furnished with the boxes. When in use, those sides of the boxes which have the open aperture are placed against a wainscot or other division in a darkened room, in which a hole has been cut, corresponding with that in the box; the hole being covered with white paper. Iodine and bromine having been placed in the glass pans, and the plate in its frame having been placed over the top, the glass cover is drawn off as far as necessary, and the colouring process immediately commences. The progress of the colouring is observed in the mirror, which by a slight movement will reflect at the same the white paper on the opposite side, and the plate on the top, which is gradually acquiring the desired tint. When sufficiently colored the cover is replaced, and effectually prevents the escape of the vapour. Where these boxes can be used conveniently, the plates may be prepared with a greater degree of nicety and certainty than by any other method.

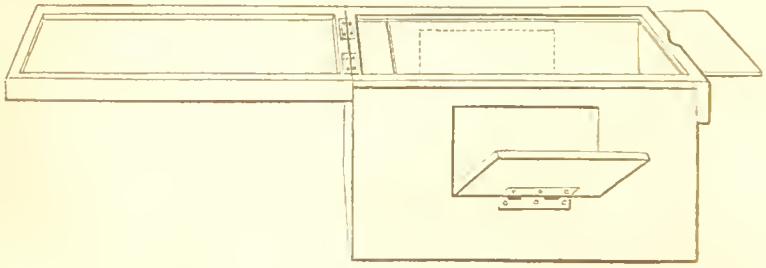


Fig. 11.

Polishing Block with Cover, (Fig. 12.)

This block is made of a shape and size convenient to the hand:—the plate adheres firmly to the prepared surface of the block, but may be readily disengaged when the process of polishing is completed.

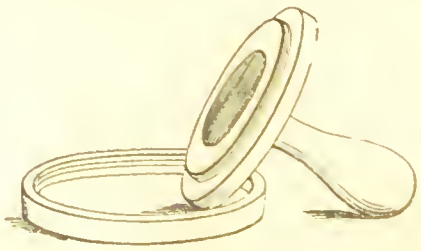


Fig. 12.

Fig. 13 is another form of block, in which the plate is held by the opposite corners. It is capable of adapting itself to various sized plates, and may be fixed to a table by means of the screw underneath.

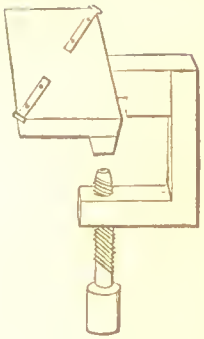


Fig. 13.

The Buff, (Fig. 14,)

Consists of a piece of wood of suitable dimensions, generally about twelve inches by three, covered with several folds of white cotton velvet, thoroughly cleansed from dirt or grease.

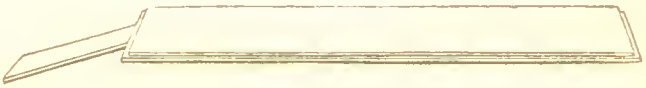


Fig. 14.

Plate Box, (Fig. 15.)

These boxes are of wood, or japanned metal, fitted with grooves which prevent the plates from touching each other:—they are very necessary to prevent the plates from being scratched or rubbed.

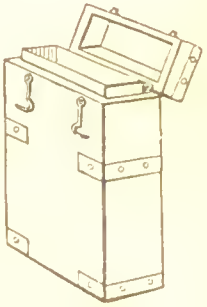


Fig. 15.

Fixing Stand, (Fig. 16.)

This is a wire sta nd, made to suppor the plate in an horizontal position, while heat is applied in the fixing process: it is also constructed with righting screws for adjustment upon unequal surfaces.

Fig. 16.

Another form is represented in fig. 17, the plate rests on the regulating screws, which are easily managed; and the stains, which sometimes occur from the plate resting on the wire itself, are thereby prevented.

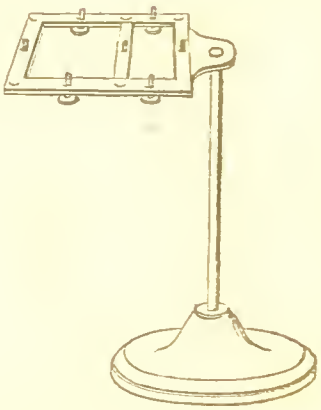


Fig. 17.

The Washing Trough, (Fig. 18,)

Is of metal, or Berlin ware, accompanied by a stand of earthenware, by which the plate is supported in the proper position while washing. An apparatus has been constructed for performing this operation with greater ease and certainty; it is, however, little used.

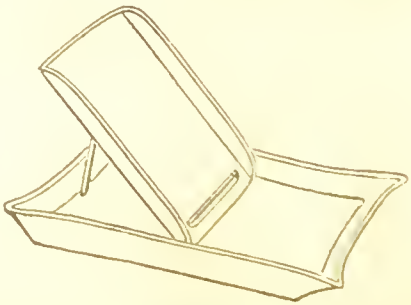


Fig. 18.

Claudet's Frame and Improved Ditto.

Both these frames are used for carrying prepared plates. The first is a thin metal frame, of the same dimensions as the plates it is intended to carry, and is placed between them to keep them from the light, and to prevent their touching each other, or gathering dust. In this state they may be tied together, and carried in the pocket without danger. The second is the same frame in a metal case, which closes tightly, and still more effectually secures them from light, dust, or contact.

The Tripod Staff, (Fig. 19,)

Upon which the camera may be rested, when no other suitable place can be found, is a very necessary auxiliary in taking views ; it is about 4 feet 6 inches high, and carries a small table on which the camera is placed.

There are several varieties differing in their construction and price.

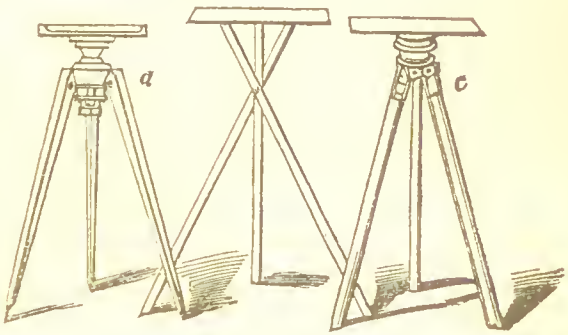


Fig. 19.

The stand should be as solid as possible, to prevent any shaking from the wind, on opening the camera, when used in the open air. In some cases a screw is arranged, to attach the camera firmly to the table.

The Head Rest, (Fig. 20,)

May be fixed to the back of an ordinary chair, and may be raised or lowered, and moved forwards or backwards, at pleasure. It is indispensable in taking portraits.

Fig. 20.

The operator will also require a spirit lamp, with a large wick, for heating the mercury, etc., etc.

Cotton Wool, which must be thoroughly clean, and free from grease.

Prepared Tripoli, or rotten stone.

Prepared Lamp Black.

Olive Oil—Alcohol.

Iodine or Chloride of Iodine.

One or other of the various sensitive solutions.

Distilled Mercury.

Hyposulphite of Soda.

Chloride of Gold, or Hyposulphite of Gold.

Frames of various sizes and patterns are made for mounting the Daguerreotype Pictures with or without morocco cases.

As success in the very delicate operations of the Daguerreotype very much depends upon the apparatus, we cannot too earnestly impress on the amateur the necessity of applying to a respectable optician, well acquainted with the construction and use of the instruments required, and who has an established reputation which he would not willingly damage. A good lens is of the utmost importance. Those manufactured by Voigtglander, Lerebours, Chevalier, and other foreign houses, have a great and deserved name; but very excellent glasses are now produced in England, and with due care in the selection it is by no means necessary to go to a French or German Atelier to get a good, useful lens. The lens must be achromatic, and the double combination lenses are to be preferred. The best are known by the absence of scratches, cracks, or flaws, and by perfect achromaticity and transparency; bubbles are of little consequence if not numerous or large. They should be free from spherical aberration such as make any of the right lines in the picture appear curved, should be immediately rejected. To secure a flat field, the greatest dimension of the plate should be at least one-half the focal length. The longer the focus, the less aberration; for steady motionless objects, it is always the best; for portraits, rapidity being very desirable, the focus may be shortened. Even here, however, accuracy of delineation should not be sacrificed, and rapidity should be sought rather from a good accelerating liquid than from a short focus lens. A diaphragm, which is a circular disc of metal, pierced in the centre with an aperture varying in diameter according to circumstances, may be necessary even for a very good lens. It is intended to exclude all the lateral rays, and to allow those only to pass which are parallel to the axis or centre of the lens. The diaphragm may have an opening of one-seventh of the focal length or more in a combination lens. The time of exposure is somewhat increased by the use of a diaphragm. All the joiner's work in the apparatus should be made of thoroughly seasoned wood carefully adjusted, and as solid as is compatible with neatness and portability.

DESCRIPTION OF THE PROCESS.

We shall now proceed to describe, briefly and clearly, the Daguerreotype process, as practised by the most successful operators of the day; omitting such variations as are not essential to the production of good proofs, and which tend rather to confuse than instruct the amateur, but not knowingly discarding anything which can facilitate his progress. And first, a remark or two on the silver plates, upon which the picture is obtained.

These plates are made expressly for the Daguerreotype. There are several sizes, the more useful of which are as follows :—

No.	1	.. 2	by	$2\frac{1}{2}$	inches.
„	2	.. $2\frac{3}{4}$	„	$3\frac{1}{4}$	„
„	3	.. 3	„	4	„
„	4	.. 4	„	5	„

The purchaser should be careful to select plates of a white metallic lustre, perfectly free from small holes, cracks, flaws, or any kind of blemish. These may be detected by breathing on the plate; and a defect or spot, however small, will become a source of great annoyance when a picture has been obtained, and much time will have been needlessly consumed in polishing and preparing them. Those that have any trace of copper appearing through the silver must be rejected.

Cleaning and Polishing the Plates.

This operation must be performed with great care. Having fixed the plate on the plate-holder, shake over it some finely-powdered tripoli, or rotten stone, add a small quantity of pure alcohol, and with a piece of prepared cotton, proceed to rub the plate with a rapid circular motion, taking care not to press upon it with much force :—the paste formed by the alcohol and tripoli, must then be well cleaned off

with fresh wool and dry tripoli, and the above process repeated two or three times, until a clean surface of pure silver is obtained. This is the best plan for a new plate;—if the plate has been used before, and the picture has not been what is termed fixed, the above operation will also suffice; but if it has been fixed, it is necessary to use a little olive oil with the tripoli in the first instance, or what is still better, a little essence of Bergamot, and then proceed with the tripoli and alcohol as before. If the picture does not readily come off, a little dilute nitric acid may be used, but with great precaution, as if not quickly removed it will eat into the silver. The plate is now ready for polishing: this is best performed by rubbing the plate rapidly over the buff, which must be kept well supplied with prepared lamp-black, pressing the plate hard and evenly against it, and changing the direction frequently, but always ending by polishing in a direction which will cross the picture you wish to obtain upon it; that is, if the plate is to be placed upright in the camera, finish it from side to side, and vice versa. The last polish should be given a short time before the plate is to be used; and any dust which may remain on it should be removed carefully, holding the plate in an inverted position, with a piece of cotton or a camel's hair pencil, just before the process of iodizing.

The best way of cleaning plates, however, is by the use of a lathe. A round buff somewhat larger than the plates to be cleaned having been mounted on the headstock, and a little oil and rotten-stone, well mixed, carefully spread over it, a plate is placed in a metal holder and held firmly against the surface of the buff:—a few turns will remove all trace of any former picture. The buff may be scraped now and then with the back of an old knife to remove the accumulated dirt, and wiped occasionally to take off any dust or grit; a drop or two of oil must be added when it gets too dry. The face of the plate having been partially cleansed from oil by rubbing it on a flat buff kept for the purpose, and the back and sides carefully wiped, it may be placed on the iron wire stand which is made for the purpose of burning off the oil which still remains on the surface. Heat is applied by dipping a little cotton fixed on the end of a piece of iron wire in naptha, lighting it and holding it under each plate till small whitish spots appear upon it. The oil buff is now to be replaced by another kept perfectly free from grease or grit, and well supplied with finely-

powdered charcoal or lamp-black kept ready in a muslin bag. A few turns will give the plate a beautiful even black polish, and it is finished off by buffing it longitudinally as before directed.

Iodizing the Plates.

A small quantity of pure iodine, or a little of the chloride of iodine, diluted with water till it assumes the color of pale sherry, is placed at the bottom of the iodizing pan. If iodine alone is used, and the pan be shallow, it is advisable to strew a little fine sand over it to prevent the too rapid rising of the vapour, and to secure an even coating. The plate is now placed on a proper frame, and laid with its face downwards on the top of the pan. In about a minute, more or less, according to the temperature of the atmosphere, it will be found to have assumed a yellow colour, which will vary from a pale to a rich golden tint, according to the time the plate is allowed to remain in contact with the vapour. The degree of intensity must be varied to suit the quality of the accelerating liquid employed, as will presently be explained. As a general rule the softest and best pictures are produced on plates iodized to a deep yellow bordering on a rose; but care must be taken that the tint does not pass to a violet, or its sensitiveness will be much diminished. The colour of the plate may be inspected by raising it and turning it towards a white light, replacing it quickly on the trough. When sufficiently iodized, it may be laid aside in the frame, with its face downwards, without injury. The iodine will last for a considerable time, if carefully covered with glass or slate; but the chloride mixture requires frequent renewal. The frames should be well varnished, and the same frames must, on no account, be introduced into the camera. It is well to wipe the edges of the trough occasionally with a bit of cotton just moistened with hyposulphite of soda. By the use of the improved pans, page 10, the operation of iodizing is rendered much more simple and certain, the color being observed in a small mirror without removing the plate.

Accelerating Liquids.

There are many varieties of these known by the names of Eau Bromée, Bromide of Iodine, Redman's Sensitive Solution, Hungarian

Liquid, etc., etc. The two latter are much used in England, and will be found to answer well if properly applied. The liquid is diluted with water in the proportion of about one dram to an ounce and a half. A sufficient quantity having been poured into the trough, the plate is placed over it, and allowed to remain until it acquires a red colour, approaching in some cases to violet. The following rules will guide the experimenter in using the different liquids. If bromide of iodine be used as the accelerating agent, the plate should remain over the iodine solution, until it is of a deep yellow tint: and over the bromide till of a deep rose colour. If Redman's solution, or the Hungarian liquid, a pale yellow and light rose will be found to answer best. As a general rule,—if the yellow colour produced by the iodine be pale, the red should be pale also; if deep, the red must incline to violet. When several plates are to be prepared at the one time, the same solution will serve for all; but it seldom answers to preserve the mixtures for any time; and its use, after keeping, is one great cause of the failures which so annoy amateurs. The bromine contained in these solutions is very subtle, and escapes, leaving little else but iodine remaining, which will after some little time give a red colour to the plate, without rendering it sensitive, entirely disappointing the expectations of the operator. The colour of the plate may be examined as before, but care must be taken to replace the plate over the solution for a few seconds, which removes the effect of the light. When the liquid is renewed at each operation, one inspection at an interval determined by experience will be generally sufficient. From thirty to sixty seconds, according to temperature, are usually required to produce the effect; in certain states of the atmosphere, a much longer time may be necessary. The plate is now ready for the camera, and may be kept for some hours, if due care is taken to secure it from light or dust. Frames to carry prepared plates, may be purchased at the opticians. The prepared plate must be transferred to the camera frame with extreme care, neither to expose it to the light, or rub the surface.

Woolcott's American Accelerator is one of the most sensitive solutions in use, but it absolutely requires the employment of the improved Pans already referred to. The plate having been iodized to a full yellow, is placed over the solution till it acquires a violet tint, and again placed over the iodine till the violet becomes a decided blue.

The ENERGETIC FLUID is a mixture containing iodine and bromine in such properties that the plate may be brought up to the proper color for use at one operation, thus avoiding the difficulties of adjusting the different tints, a quality very valuable to amateurs. It should be frequently renewed.

The bottles containing the sensitive solutions should be protected from the light by a band of black paper; and they should never be kept in a sleeping apartment, the vapour which is constantly escaping being injurious to the health.

EXPOSURE IN THE CAMERA.

The form of camera most suitable for the purpose has been already described, page 6. The inside should be carefully dusted before using. Having been placed opposite to the object to be copied, and made perfectly steady, a clear and distinct representation of the object should be obtained upon the ground glass, which must then be withdrawn, and the frame containing the prepared plate introduced in its place,—the lens being covered with the brass cap. The shutter may then be drawn up, the cap removed, and the plate exposed to the light which passes through the lens. The time of exposure must be decided by observation and experiment; as so much depends on the size and construction of the lens or lenses, and the brightness or dulness of the season. With a good achromatic lens, from five seconds to a minute and a half, will be sufficient in almost every case. In another part will be found some Directions for taking Portraits, Views, etc. which will assist the beginner. The instant the assigned time has elapsed, the cap must be replaced, the shutter closed, and the frame may then be withdrawn in readiness for the next operation.

EXPOSING THE PLATE TO THE VAPOUR OF MERCURY.

Into the cup at the bottom of the mercury-box put four or five ounces of mercury, which must be pure, dry, and free from moisture. It may be occasionally filtered by enclosing it in Chamois leather, and gradually and carefully twisting the leather, till the mercury is forced through its pores clean and bright. The vapour of the mercury is

raised by the application of a spirit-lamp to the cup which holds the mercury. When a thermometer is attached to the mercury-box, a temperature of about 90 degrees will raise the vapour of the mercury: if the box have no thermometer, the cup may be heated until the mercury is quite warm to the finger. If the mercury cup is removed from the box in order to its being heated, it is well after that operation to wipe the outside, on which a slight steam from the spirit may have settled. The plate is then placed over the mercury, where it must remain till the picture is perfectly developed. Its progress may be observed by the light of a candle through the yellow glass in the front of the box. It generally takes eight to fifteen minutes, or even longer, to perfect the operation; if, however, no outline is visible in about three minutes, either the mercury has not been sufficiently heated, or the picture has been removed too soon from the influence of light in the camera. If the former be the case, the mercury may be again gently heated; but if made too hot, the plate will become covered with small white spots. The details are usually much better developed when the picture has been brought out slowly, and with a moderate degree of heat. Pictures which have been exposed for a sufficient time in the camera, seldom receive any injury from the mercury. The picture should remain in the box till the darker parts are well developed, which may be increased at the last moment till the picture is perfectly distinct.

Setting the Picture.

The picture being sufficiently developed, it should be immersed as speedily as possible in a pretty strong solution of hyposulphite of soda, about fifty grains to the ounce; and when the color is entirely removed, transferred to a vessel of distilled water. The washing troughs already described are very convenient for this purpose. The plate should be carefully washed before proceeding to the next process. The hyposulphite solution may serve many times, if it be carefully filtered before using, and the strength kept up by adding a little of the salt from time to time.

Fixing the Image.

The plate being taken from the water, which should never be

allowed to dry off, is placed upon the fixing stand, which is so constructed as to preserve it in a perfectly horizontal position. The gold solution, which may be purchased of the opticians and chemists, or prepared according to the formula given in the Appendix, is poured on the plate, until it is entirely covered, and the flame of a large spirit lamp applied to the under surface, moving it gently backwards and forwards in such a way that every part may be equally heated. The picture will speedily darken, and then in a few moments become very clear and bright, when the lamp must be withdrawn, and the plate removed, and again plunged into cold water. The plate is now finally washed, by pouring pure water at a boiling heat over it, holding it as perpendicularly as possible. When the plate is quite clean, it may be dried by blowing gently downwards, and when neatly managed it will be quite free from spots. The plate may be supported on a stand, as in the washing apparatus, Fig. 12, page 8, or held at the corner with a pair of pliars. The gold solution must be rejected if it should have changed colour, or deposited any precipitate.

There is an apparatus for washing plates, much used by those who follow Photography as a profession, and which the amateur will sometimes find very useful if not essential. It consists of a small copper trough attached to a barrel of distilled water. This trough contains a moveable frame, upon which the plate rests, and which becomes immersed in water by turning a small tap in the barrel. The trough having been heated by a spirit lamp, until the water is nearly boiling, the plate is raised gently by a wire attached to the frame; and by gently blowing on it as it rises, it may be removed perfectly free from stains.

The following mode of fixing and strengthening pictures by oxidation, has been proposed by Mr. Charles G. Page, M. D., Professor of Chemistry, Columbia College, Washington:—

The impression being obtained upon a highly polished plate, and made to receive, by galvanic agency, a very slight deposit of copper from the cupreous cyanide of potassa, (the deposit of copper being just enough to change the colour of the plate in the slightest degree,) is washed very carefully with distilled water, and then heated over a spirit lamp, until the light parts assume a pearly transparent appearance. The whitening and cleaning up of the picture by this process

is by far more beautiful than by the ordinary method of fixation by a deposit of gold. A small portrait fixed in this way, more than a year since, remains unchanged, and continues to be the admiration of persons interested in this art. One remarkable effect produced by this mode of fixing, is the great hardening of the surface, so that the impression is effaced with great difficulty. I have kept a small portrait, thus treated, unsealed and uncovered for over a year, and have frequently exposed it in various ways, and rubbed it smartly with a tuft of cotton, without apparently injuring it; in fact, the oxidised surface is as little liable to change as the surface of gold, and is much harder.

To succeed well in this process, the impression should be carried as far as possible without solarization; the solution of the hyposulphite of soda should be pure, and free from the traces of sulphur; the plate should be carefully washed with distilled water, both before and after it receives the deposit of copper,—in fact, the whole experiment should be neatly performed, to prevent what the French significantly call *taches* upon the plate, when the copper comes to be oxidized.

The formula for the Daguerreotype process, which has now been given, will, we trust, enable the amateur to pursue his experiments with confidence and success. He will probably experience some disappointments, however carefully he may attend to the rules which have been laid down, for there are few among even the ablest experimenters who do not occasionally fail; yet his perseverance will often be rewarded by an excellent picture, when perhaps he least expects it.

To obviate, as much as possible, these annoying failures, he should bear in mind the following Cautions, by which he may ofttimes discover the causes which prevent his success:—

Cautions.

1st. Never use the same accelerating liquid more than once or twice, and only at short intervals. It is better to throw it away after preparing such plates as can be prepared at the same time.

2nd. Be sure to replace the plate on the accelerating liquid for a

moment or two after having observed the colour, and before putting it in the camera.

3rd. Wipe the lens, and remove all dust and dampness from the camera before using.

4th. Keep the camera and mercury-box perfectly free from the vapour of iodine, bromine, etc.

5th. Frequently brush the top and sides of the mercury-box to remove any particles which may adhere to them, and which would be likely to settle on the plate. A small painter's tool will do well for this purpose. Filter the mercury through a piece of chamois leather, if it should have film or dust collected upon it ; the hyposulphite solution, used to remove the colour of the plate in setting, must also be filtered before using.

6th. Never use the gold solution after it has changed colour, or thrown down a precipitate. This solution requires filtering occasionally.

7th. Do not make the mercury too hot, it will spot the plate, and spoil the picture.

8th. The direct rays of light must not enter the camera in conjunction with those reflected from the object.

9th. If the picture appear clouded, it is probably either because the plate has not been thoroughly cleaned, or has absorbed too much bromine; in the former case, the plate must be cleaned more carefully, in the latter the accelerating liquid must be changed, or its strength reduced. If it be covered with a white film, the plate has been exposed to light before putting into the camera, or too much light has entered the camera, which may be remedied by using a smaller diaphragm. If the whites have become blue, or the picture is thin and poor, it has not become sufficiently deep in colour over the iodine ; if browned, it is solarized.

COLOURED DAGUERREOTYPES.

Daguerreotype Portraits are now frequently met with beautifully colored; but the coloring is a process requiring great care and judgment, and many good pictures are spoilt in fruitless experiments. Several different methods of coloring have been proposed. The simplest mode appears to be that of using dry colours prepared in the following manner. A little of the colour required, very finely ground, is thrown into a glass containing water, in which a few grains of gum-arabic have been dissolved. After standing a few moments, the mixture may be passed through bibulous paper, and the residue perfectly dried for use. A little of this colour may be rubbed off with a small camel's hair pencil, and applied very carefully to the picture, to which it will adhere. Any superfluous colour may be removed by a clear pencil. The flesh tints are obtained by use of chrome yellow, Jaune de Mars, etc. to which a little rouge or carmine may be added. Ultramarine gives a beautiful blue colour, and if the back ground is thus tinted, a portrait is frequently thrown up in a very beautiful manner. By combining these, greens and purples may be obtained, very useful for dresses, curtains, etc.

Mr. Claudet's method is to dip a finely-pointed pencil in spirits of wine, and taking a little of the colour, which must have been pounded with spirits of wine, and again pulverized in a glass mortar, to apply it upon the plate. This coating must be slight, and may be repeated if necessary; but if too much is put on, it is difficult to remove: the dry colour is applied on this coating, to which it will be found to adhere.

Mr. Chevallier's plan is to trace on the glass, which is intended to protect it, the outline of the picture, and then to tint it with the colours used for painting the dissolving views, so as to correspond with the picture underneath. When dry, the tracing may be effaced, the glass fixed, and the picture will then appear through, something in the style of a coloured lithograph.

M. Leotard de Senze covers the plate with a transparent membrane, or vegetable paper, which he attaches by a solution of gum

or size, heated in a water bath; on this membrane he applies colours, mixed with with spirits of wine and gum, or with white varnish and alum.*

Mr. Page, whose new method of fixing the Daguerreotype proofs is given page 15, has thrown out the following suggestions on the subject of Colouring:—

As copper assumes various colours, according to the depth of oxidation upon its surfaee, it follows, that if a thicker coating than the first mentioned can be put upon the plate, without impairing the impression, various colours may be obtained during the fixation. It is impossible for me to give any definite rules concerning this last process; but I will state, in a general way, that my best results were obtained by giving the plate such a eoating of eopper as to change the tone of the pieture, that is, give it a coppery colour, and then heating it over a spirit lamp until it assumes the colour desired. I have now an exposed picture treated in this way at the same time with the two above-mentioned, and it remains unchanged. It is of a beautiful green eolour, and the impression has not suffered in the least by the oxidation. Should this process he perfected, so as to render it generally available, it will be greatly superior to the present inartistical mode of stippling dry colours upon the impression, for the colour here is due to the surface of the pieture itself. For pure landscapes, it has a pleasing effeet; and by adopting some of the recent inventions for stopping out the deposit of copper, the green colour may be had wherever desired. In some pictures, a curious variety of colours is obtained, owing to the thiekness of the deposit of copper, which is governed by the thickness of the deposit of mercury forming the picture. In one instance, a clear and beautiful ruby colour was produced, limited in a well-defined manner to the drapery, while all the other parts were green.

PORTRAITS.

Without doubt the most valuable application of the Daguerreotype is to the eopying the "human face divine," and it is unquestionably

* These three receipts are condensed from M. Lerebour's excellent Traitê de Photographie, from which other valuable suggestions are taken.

the most difficult. The professional Photographer who operates under a glazed roof with a carefully arranged light, and an ample supply of the necessary material, often fails in producing really first-rate portraits; and it cannot be wondered at that the amateur, working frequently under very disadvantageous circumstances, should require the most careful attention, and above all exemplary patience to ensure a tolerable degree of success. The following observations, derived from personal experience, or the writings of persons well acquainted with the subject, may serve to diminish the difficulties to which we refer. If the portrait be taken in a room, the sitter must be placed before an open door or window, which gives free access to the light, and it may be well to dispose one or two white screens around to reflect it upon the person; a bright day must also be selected for the operation. If in the open air, place a white canopy over the head of the sitter, a white curtain on one side, and a black, or at least a dark one, on the other. Foggy, hazy, or windy weather, must of course be avoided; the best time for operating, is when the sky is covered with light clouds. For a back ground, nothing is better than a crimson or slate colour druggett; if it is required to be lighter, an old blanket will answer the purpose well.

The dress is a matter but of little importance, but much white is objectionable. Dark-coloured silks and plaids are very suitable, and lace collars and cuffs have a very good effect. The sitter should be comfortably seated, and assume an easy natural position; the head should be kept horizontally, the intellectual rather than the lower part being, if anything, rather nearer the camera. As the sides of the face are sometimes very different, it is necessary to select that which conveys the most pleasing expression; what is called a three-quarter face, is most satisfactory, but there are cases where a profile or a full face is more desirable. The face should be turned towards the darker curtain, the eyes well open and directed to some object placed directly before them, at a proper height. The hands and arms should fall naturally, and should be kept as much as possible in the same plane as the rest of the body, to prevent distortion; for the same reason, the legs should not be put more forward than absolutely necessary. In full lengths the person should rest upon a pillar, piece of furniture, or some other appropriate and elegant object. In a group, each individual should be arranged in a different attitude, but the whole nearly in the same

plane. In all cases the sitters must remain perfectly still, and not remove their eyes from the object, though they may wink them occasionally, rather than suffer them to become staring and fixed. In cases where, from some peculiar marks on the face, it is necessary to take it according to its natural appearance, the use of the parallel mirror will be essential, but the time of exposure will be lengthened at least one-third.

A table with books, vases of flowers, etc. may be arranged at the side of the sitter, and occasionally a painted scene representing a terrace, balcony, garden, etc. may be used as a back-ground. For portraits, a short focus lens is best and due care must be taken to obtain a very clear distinct image. The time required varies from twenty seconds to a minute and a half, according to the position, weather, etc.

Views.—The points from which buildings or views can be taken with the best advantage, vary so greatly that the operator must be left pretty much to his own discretion, in choosing a position. As a general rule in taking a building, monuments, etc., it is advisable to place the camera at a distance of about twice its greatest dimensions, and, if practicable, at about one-third its height. If the whole of the building or buildings be not in the same plane, select the most important portion to be most clearly defined, or take several views, in each of which certain points are brought out more distinctly. If an old and new building are to be introduced in the same picture, which should, if possible, be avoided, a black screen or handkerchief, or some other opaque body, should be placed over the lens for a moment or two, so as to cut off the rays of light reflected from the brighter portions of the object, the position of which may be previously observed on the ground glass. The same precaution should be taken when the sky is very blue, or strongly illuminated by the sun. The best time for taking views, is undoubtedly the earlier part of the day, though good pictures are often taken in the afternoon. The time required to obtain a good impression varies so much according to the lens, the weather, the hour, etc., that no certain rules can be given on the subject,—experience will prove the best guide.

Engravings, Drawings, etc. may be copied very beautifully with a little care; the whole of the model being in the same plane, there is little difficulty in producing a good effect. The object to be copied must be placed in a good light, taking care to have every part equally illuminated. To secure sharpness, the model is placed in the open daylight, in which case a proof may generally be procured in about fifteen seconds; in the full sunshine, the impression is made almost instantaneously.

Machinery, Statuary, and Articles of Vertu, require to be arranged in suitable positions, so that the light may fall upon the object most effectively. The light may be reflected from mirrors, white linens, etc. etc.

Copying Daguerreotype Pictures.

Very fine copies of these pictures, equal to the original in beauty of delineation, and frequently superior in point of tone, are obtained by means of a camera constructed for the purpose; but its use is almost entirely confined to the photographic establishments. Another mode of copying is by the Electrotype. This process, which will be fully described in a Manual now in preparation, and shortly to be published, may be made sufficiently clear, in a few words, to enable the amateur to make the experiment with a a Dguerreotype proof.

The apparatus figured in the margin, consists of a single cell of a Smee's battery, which consists of a thin sheet of platinized silver placed between two plates of amalgamated zinc; these are immersed in sulphuric acid and water in a suitable jar, and attached to each metal is a binding screw to form the necessary connections.

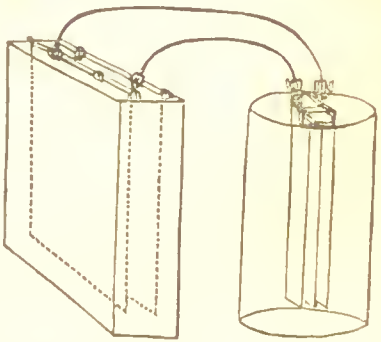


Fig. 21.

The larger cell in the figure is termed the decomposition cell, and is filled with a saturated solution of sulphate of copper, prepared

cold, and carefully filtered, into which the plate to be copied is to be afterwards plunged, together with a plate of copper of the same size, intended to supply the place of the copper withdrawn from the solution.

The Daguerreotype proof must be very carefully executed, avoiding all stains or grease—well washed from the hyposulphite solution—gilded at a low heat, but very thoroughly ; and should be dried off with alcohol which leaves the surface clean and free from spots.

A piece of copper wire is now attached to one corner by soldering, or with a binding screw, taking care that the connection between the plate and the wire is perfect, without which precaution the attempt to electrotype will certainly prove a failure ; and the back of the plate is then varnished with a little white wax, or other non-conducting substance. Having prepared a piece of copper of about the same size and thickness as the proof, and attached to it a piece of copper wire, connect them by means of the binding screws with the poles of the battery, in such a manner that the proof shall be connected with the zinc or positive pole, and the copper with the opposite or negative pole and so arrange them that the piece of copper shall be directly opposite and parallel to the proof, at a little distance from it. When this arrangement is made, the proof and the plate should be plunged carefully but rapidly and simultaneously into the decomposition cell, and if the connections are sufficiently established the deposition of copper on the proof will commence immediately. The solution should be stirred occasionally and the deposit ought to be of a brilliant coppery pink, smooth and close grained. If it consist of a brownish powder, or be chrystalised, either the solution is too weak or the battery too powerful, and the operation must be recommenced. The proof may be removed from the solution for inspection occasionally, but must on no account be suffered to dry before the surface is completely covered. Care should also be taken that no air bubbles are left on the surface of the proof after immersion ; they may be removed by blowing downwards on the plate.

When the deposit is of the thickness of a slight card, which it will be in the course of a few hours, it may be removed from the solution, and carefully dried in blotting paper. When dry, the edges all round must be carefully filed, until the deposit will separate from the proof. The counterproof should be immediately placed in a frame or

case under glass, to protect it from air or dust, which would inevitably injure the fine work. These electrotypes are very beautiful and perfect, when carefully managed; but they require practice, and a close attention to the directions given.

ENGRAVING DAGUERREOTYPE PLATES.

Several plans have been suggested for accomplishing this much desired object; none however seem so well adapted as the following, recently patented by M. Claudet, to whom the art is already much indebted. In the specification, the process is explained as follows:—

The process is established upon the following facts, which have come to the knowledge of the inventor:—

1. A mixed acid, composed of water, nitric acid, nitrate of potassa, and common salt, in certain proportions, being poured upon a Daguerreotype picture attacks the pure silver, forming a chloride of that metal, and does not effect the white parts, which are produced by the mercury; but this action does not continue long. Then by a treatment with ammonia (ammonia containing already chloride of silver in solution is preferable for this operation), the chloride of silver is dissolved, and washed off, and the metal being again in its naked state, or cleansed from the chloride, it can be attacked afresh by the same acid. This acid acts better warm than cold.

2. As all metallic surfaces are soon covered, when exposed to the atmosphere, with greasy or resinous matters, it is necessary, in order that the action of the acid upon the pure silver should have its full effect, for the surface to be perfectly purified; this is effected by the employment of alcohol and caustic potash.

3. When a Daguerreotype picture is submitted to the effect of a boiling concentrated solution of caustic potash, before being attacked by the acid, the state of its surface is so modified that the acid spares, or leaves, in the parts which it attacks, a great number of points, which form the grain of the engraving.

4. When the effect of the acid is not sufficient, or in other words, if it has not bitten deep enough, the effect is increased by the following process:—Ink the plate as copper-plate printers do, but with a siccative

ink ; when the ink is sufficiently dry, polish the white parts of the plate, and gild it by the electrotype process ; then wash it with warm caustic potash, and bite in with an acid, which will not attack the gold, but only the metal in those parts which, having been protected by the ink, have not received the coating of gold. By these means the engraving is completed, as by the action of the acid alone it is not generally bitten in deep enough.

5. To protect the plate from the effects of wear, produced by the operation of printing, the following process is employed :—The surface of the plate is covered with a very thin coating of copper, by means of the electrotype process, before submitting it to the operation of printing ; and when that pellicle or coating of copper begins to show signs of wear, it must be removed altogether, by plunging the plate in ammonia, or in a weak acid which, by electro-chemical action, will dissolve the copper, without affecting the metal under it; the plate is then coppered again, by the same means, and is then ready for producing a further number of impressions. This re-coating operation may be repeated as many times as may be required. The following is the description of the whole process, which is divided into two parts, consisting of a preparatory and finishing process :—

Preparatory Engraving.—For this operation, which is the most delicate, it is necessary to have, 1. A saturated solution of caustic potash. 2. Pure nitric acid at 38° of the arcometer of Beaumé (spec. grav. 1.33.) 3. A solution of nitrite of potassa, composed of 30 parts of water and 5 parts of nitrite, by weight. 4. A solution of common salt composed of water 100 parts, and salt 10 parts, by weight. 5. A weak solution of ammoniacal chloride of silver, with an excess of ammonia. The ammoniacal chloride of silver must be diluted with 15 or 20 parts of pure water. In the description of the process, this solution will be called ammoniacal chloride of silver. 6. A weak solution of ammonia containing 4 or 5 thousandths of liquid ammonia. This solution will be called ammoniacal water. 7. A weak solution of caustic potash containing 4 or 5 thousandths of the saturated solution, which will be called akaline water. 8. A solution composed on water 4 parts, saturated solution of potash 2 parts, alcohol 1 part, all in volume. This solution will be called alcoholized potash. 9. Acidulated water, composed of water 100 parts, and nitric acid 2 parts, in volume. Besides, it is

necessary to have three capsulæ or dishes, made of porcelain, large enough to contain the plate, and covered with an air-tight piece of ground plate glass, and two or three more capsulæ which do not require to be covered; two or three glass funnels, to wash the plate; and two or three glass holders in the shape of a spoon or shovel, by which the plate is supported when put in and taken out of the solution, without touching it with the fingers.

The Daguerreotype plate is submitted to the engraving process, after having been washed in the hyposulphite of soda, and afterwards in distilled water.

First process for biting in or engraving the plate.—The following solutions must be put in the capsulæ, in sufficient quantity, so as to entirely cover the plate:—1. Acidulated water. 2. Alkaline water. 3. Alcoholized potash in covered capsulæ. 4. Caustic potash in covered capsulæ. 5. Distilled water.

The plate being put upon the glass holder or spoon, is plunged in the acidulated water, and agitated during a few seconds, then put into a glass funnel, and washed with distilled water. It is taken again with the glass spoon, and plunged in the capsula containing alcoholized potash. This capsula is covered with its glass cover, and then heated by means of a spirit lamp, to about 111° Fahrenheit. The plate must remain in the capsula half an hour, during which the solution is heated now and then, and agitated. During that time, the following acid solution, which will be called *normal acid*, must be prepared; it is composed as follows:—Water 600 parts, nitric acid 45 parts, solution of nitrite of potassa 12 parts, solution of common salt 45 parts. These proportions are in volume. The normal acid must be poured in a capsula, covered with its glass cover, and a sufficient quantity must be kept in the bottle.

When the plate has been immersed in the alcoholized potash during half an hour, it is taken out of the solution by means of the glass holder, and immediately plunged in the alkaline water, and agitated pretty strongly; from thence it is put in distilled water. (A.)

This being done, the plate is plunged into acidulated water, and moved about therein for a few seconds: it is then put in the normal acid. When the plate has been immersed a few seconds in the acid it is taken out by means of the glass holder, taking care to keep it as much as possible covered with the solution, and it is immediately placed

horizontally upon a stand, and as much acid as the plate can hold is poured upon it from the bottle; it is then heated with a spirit lamp, but without attaining the boiling point. During this operation it is better to stir or move about the acid on the plate by pumping it, and ejecting it again, by means of a pipette or glass syringe; after two or three minutes the acid is thrown away, the plate is put into the glass funnel, and there well washed with water, and afterwards with distilled water. (B)

Then without letting the plate dry, it is put upon the fingers of the left hand, and with the right hand some ammoniacal chloride of silver, which is moved about the surface by balancing the hand. is poured upon it; the solution is renewed until the chloride, formed by the action of the acid, is dissolved; the plate is then washed by pouring upon it a large quantity of ammoniacal water, and afterwards some distilled water. (C)

Without allowing the plate to dry, it is then put in the caustic potash, and the capsula being placed upon the stand, the potash is heated up to the boiling point. It is then left to cool (D); and beginning again the operations described from A to D, a second biting is obtained; and by repeating again the operations described in A and B, a third biting is produced. The plate is then dried; in this state the black parts of the plate are filled with chloride of silver.

The plate is then polished until the white parts are perfectly pure and bright. This polishing is done with cotton and "ponce" (pumice stone); afterwards, the chloride of silver, filling the black parts, is cleansed by the means described in B and C. The plate is then dried; but before drying, it is well to rub the plate slightly with the finger, in order to take off from the black parts any remains of an insoluble body which generally remain on it. The preparatory engraving is then finished, and the plate has the appearance of a very delicate aquatint engraved plate, not very deeply bitten in.

Nevertheless, if the operation has been well managed, and has been successful, it is deep enough to allow the printing of a considerable number of copies.

Note.—Sometimes, instead of treating the plate with the boiling potash in the capsula, a similar result may be obtained by placing the plate upon the stand, covering it with the solution, and heating it by means of a spirit lamp, until, by evaporation, the potash becomes in a state of

ignited fusion. By this means the grain is finer, but the white parts are more liable to be attacked.

Last operation of biting in.—This operation requires some of the re-agents before named, and also,

1. A siccative ink, made of linseed oil, rendered very siccative by boiling it sufficiently with litharge ; it may be thickened with calcined lamp-black.

2. An electrotype apparatus, and some solutions fit to gild and copper the plate.

Means of operating.—The plate must be inked as copper-plate printers do, taking care to clean off the white parts more perfectly than usual ; the plate is then to be placed in a room sufficiently warm, until the ink is well dried, which requires more or less time, according to the nature of the oil employed. The drying of the oil may be hastened by heating the plate upon the stand with the lamp, but the slow process is more perfect and certain.

When the ink is well dried, the white parts are cleaned again by polishing the plate with cotton and pounce, or any other polishing powder : a ball of cotton, or any other matter, covered with a thin piece of caoutchouc or skin, can be used for this purpose. When polished, the plate is ready to receive the electro-chemical-coating of gold, which will protect the white parts.

Gilding.— The gilding is obtained by any of the various processes of electrotyping which are known. The only indispensable condition is, that the surface obtained by the precipitation must not be liable to be attacked by any weak acid ; a solution answering this purpose is made of ten parts (by weight) of ferrocyanide of potassium, one part of chloride of gold, and 1000 parts of water, used with a galvanic battery. During the gilding the plate must be turned in several positions, in order to regulate the metallic deposit. In some cases the gilding may be made more perfect, if the plate is covered with a thin coating of mercury before being put in the gilding solution.

When the plate is gilded, it must be treated with the boiling caustic potash, by the process already indicated for the preparatory engraving, in order to cleanse it from all the dried oil or ink which fills the hollows.

The plate is then washed and dried, and when the oil employed has been thickened with the lamp black, the surface of the plate is rubbed with crumb of bread, in order to cleanse and take off the black remaining; then, the white parts being covered and protected by a varnish not liable to be attacked, and the black parts being uncovered and clean, the plate can be bitten in by aquafortis, according to the ordinary process used by engravers.

This operation must be done upon the stand, and not by immersing the plate in the solution.

Before this last biting-in, if the preparatory engraving has not succeeded well, and the plate still wants a sufficient grain, it can be given by the various processes of aquatint engraving.

Before submitting the plate to the operation of printing, in order to secure an unlimited number of copies, it is necessary, as before stated to protect it by a slight coating of copper, which is obtained by the electrotype process; otherwise the printing would soon wear the plate. This coating must be kept very thin, lest the fineness of the engraving, and the polish of the white parts, should be destroyed. In this state the plate can be delivered to the printer.

After a certain number of impressions have been obtained, it will be perceived that the coating of copper is worn in some places; then this coating must be removed, and a fresh one applied in its place. For this purpose, the plate must be purified and cleansed by warm potash, and plunged in a weak acid composed as follows:—Water 600 parts; nitric acid 60 parts; nitrous acid of engravers, 5 parts; all in volume. This acid will dissolve the coating of copper, and the plate being coppered again by the same means as before, may be again admitted to the operation of printing; and as nothing can prevent the success of a repetition of the same operation, any number of impressions may be obtained. The coating of copper can also be removed by caustic ammonia.

The Daguerreotype Plates engraved by this process, which constitutes the present invention, consist,—

First—In the discovery and employment of certain properties of a mixture composed of nitric acid, nitrous acid, and hydrocloric acid, in determined or fixed proportions. The two last mentioned acids may be employed either in a free state, or combined with alkaline or other basis. This mixed acid has the property of biting the pure silver

which forms the black parts of the Daguerreotype picture, without attacking the white parts formed by the amalgam of mercury. The result of the action of the biting is to form on the black parts of the picture an insoluble chloride of silver; and this chloride of silver, which when formed stops the action of the acid, is dissolved by ammonia, which allows the biting to continue.

Secondly,—In the discovery of certain properties of a warm solution of caustic potash, and in the employment of the said solution, by which the mercury forming the picture is better and deeper amalgamated with the silver under it, so that many imperceptible points of the amalgam are effected in such a manner that the acid has no action upon them.

Thirdly,—In the discovery and employment of a process which produces a grain favourable to the engraving, by which the biting on the plate is rendered deeper. This is effected by filling the parts engraved with a siccative ink, or any other substance, and then gilding the plate by the electrotype process; the gold is not deposited on the parts protected by the ink. When the plate is gilded, the ink is cleansed by the caustic potash, and the plate may be submitted to the effects of an acid which does not attack the coating of gold, but bites only on the silver in the parts already engraved by the first operation.

Fourthly,—In the employment of a process by which the plate is protected from the wear of the printing operation. This is effected by covering the plate, before printing, with a slight coating of copper by the electrotype process; and when the coating begins to wear by printing, it is removed by a weak acid, or by ammonia, which dissolves the copper without affecting the silver under it. The plate is coppered again, and after another printing the same operation is repeated, so that a considerable number of copies may be printed without much injury to the engraving.

APPENDIX.

We subjoin the formula for making a few of the solutions used in the Daguerreotype process; but we must caution those who may be ignorant of Chemistry, that some of the substances used are delcterious and corrosive, and that great care should be taken that they do not touch the person, dress, or surrounding objects. A drop of bromine for example, accidentally thrown into the eye might easily destroy the sight.

Chloride of Iodine.

The chlorine is procured, by putting pure oxide of manganese, broken into small pieces in a glass retort, and pouring upon it some hydro-chlorie (muriatic) acid. The retort communicates by a bent tube with a small bottle containing iodine, which it promptly liquefies. When the resulting liquid becomes a bright red, the operation is complete. The chloride of iodine should be preserved in a bottle well stopped, a little white wax round the stopper will prevent its adhering to the neek of the bottle. In conducting this operation, precaution must be taken that the chlorine does not escape; this gas being highly deleterious.

Eau Bromee.

Add an excess of bromine to pure water* in a bottle, shaking it well for some minutes. To one part of this solution, add 40 parts water, and the mixture of a bright yellow is ready for use.

* If you are not sure of the purity of the water, add a few drops of nitric acid.

Bromide of Iodine.

In a bottle which holds about three ounces, put 30 to 40 drops of bromine,—the quantity is not very important. Add iodine, grain by grain, till the bromine is saturated. The iodine which does not dissolve may remain in the bottle. To one part of bromide of iodine add 200 parts water, and it is ready for use.

Gilding Solution.

The receipt for this solution, as given by M. Fizeau, the inventor of this method of fixing, is as follows:—

Dissolve one part of chloride gold in 800 parts of water, and four parts hyposulphite soda in 200 parts water,—pour the solution of gold into that of soda by little and little, shaking it all the while, the mixture at first slightly yellow becomes perfectly limpid. This mixture may be bought ready prepared of the Opticians.

Comparison of French and English Measures

Measures of Weight.

	English Grains.	Avoird. Weight
Decigramme	1.5433 ..	
Gramme	15.4330 ..	
Decigramme	154.3300 ..	0.022
Hectogramme	1543.330 ..	0.220
Kilogramme	15433 0000 ..	2.204

Measures of Capacity.

	Imperial. Galls.		Pints.
Litre	0	..	1.76377
Decalitre	2	..	1.4464

Specimen of Palmer's Patent Glyphography.